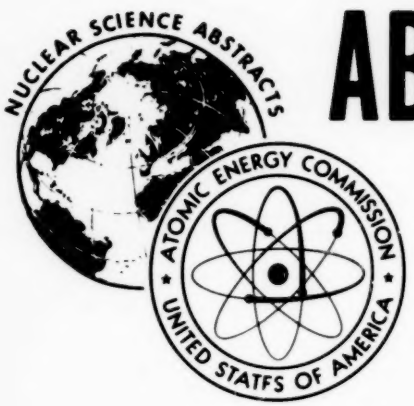
NUCLEAR SCIENCE ABSTRACTS



Volume 25 Number 1

Abstracts 1-2058

January 15, 1971

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Volume 25, Number 1, January 15, 1971

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted:

ISHIHARA, T., Accumulation of fallout ^{137}Cs in newborn infants, 23:50538
ISHIHARA, Toyokuki, Shielding effect of paraffin, water, soil, concrete, Fe, and Pb for high-energy neutrons, 23:51748

Subjects

The subject index consisting of specific materials, objects, and processes is arranged alphabetically. Modifying phrases specific to these subjects in turn are arranged alphabetically under the subjects.

MELPHALAN
effects on proliferation of cultured antigen-stimulated spleen cells from mice, dose-response curve for, 23:50820
MEMBRANE FILTERS
design for removal of cell-free Streptococcus faecalus from bacteria cultures in fermentation tank, 23:49996 (UCRL-18667, pp 322-9)
MENDELEVIUM
separation from einsteinium and fermium by electrolysis, 23:49772 (UCRL-18667, pp 277-312)
separation from sodium acetate solutions by solvent extraction using sodium amalgam, 23:49772 (UCRL-18667, pp 277-312)
stability of divalent state of, 23:49772 (UCRL-18667, pp 277-312)

Corporate Authors

Technical report literature is indexed from the name of the organization or institution responsible for the issuance of the report.

51093 (LA-4164) FABRICATION OF BORON CARBIDE RINGS AND DISKS. Sheinberg, H.; Herrera, T.; Kostacopoulos, J. **(Los Alamos Scientific Lab., N. Mex.).** Apr. 25, 1969. Contract W-7405-eng-36. 11p. Dep. CFSTI.

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Volume 25, Number 1 January 15, 1971

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical Chemistry

Refer also to abstracts 63, 64, and 198.

1 (GEAP-12114-1) PLANT INSTRUMENTATION PROGRAM. First Quarterly Report, April–June 1970. Bishop, D. M.; Aitken, E. A. (comps.) (General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation). Jul 1970. Contract AT(30-1)-68. 25p. (BHO-68-1). Dep. NTIS.

Work was initiated on the Plant Instrumentation Program during mid-April 1970 immediately after contract receipt. The program is directed toward the evaluation of nondestructive techniques and equipment for assaying special nuclear materials under fuel fabrication plant conditions. Work scope and fuel standards are defined. Gamma counting assay techniques and calorimetric assay equipment are described. A spectral stripping technique is proposed to permit the assay of plutonium content in mixed oxide fuels with a sodium iodide gamma counting system. (auth)

2 (STI/DOC-10/118) REFERENCE METHODS FOR MARINE RADIOACTIVITY STUDIES. Technical Reports Series No. 118. (International Atomic Energy Agency, Vienna (Austria)). 1970. 294p. IAEA $7.00.

Methods for determining selected radioisotopes and their stable counterparts of Ce, Co, Cs, Sr, and Zn in marine organisms and their environment are presented. These methods are recommended by the IAEA in order to ensure the comparability of results obtained at laboratories throughout the world. (L.C.L.)

3 SULPHOXIDES AS SOLVATING REAGENTS FOR THE SEPARATION OF METAL IONS. Kennedy, David C.; Fritz, J. S. (Ames Lab., Iowa). Talanta; 27: 823-35(Sep 1970).

The solvent extraction properties of the following sulphoxides were evaluated: di-n-octyl sulphoxide (DOSO), bis(n-octylsulphinyl) methane (BOSM), bis(n-octylsulphinyl)ethane (BOSE) and p-tolyl sulphoxide (PTSO). By use of reversed-phase paper chromatography as a qualitative surveying technique, the interactions of these sulphoxides with some fifty metal ions were investigated in several acid-ligand systems. All sulphoxides were studied in 1 to 10M hydrochloric and nitric acids; DOSO and BOSM were also studied in perchloric acid and ammonium thiocyanate-perchloric acid mixtures. Observations are made concerning sulphoxide-metal interactions and the existence of several useful analytical separation systems is pointed out. The synthesis and characterization of BOSM and BOSE are described. (auth) (UK)

Chemical and Spectral Procedures

Refer also to abstract 231.

4 (BNWL-MA-76(Rev.2)) PACIFIC NORTHWEST LABORATORY MANUAL OF PROCEDURES FOR THE ANALYSIS OF METALLIC SODIUM. Keough, R. F. (ed.) (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jun 1970. 78p. Dep. NTIS.

Methods used for the chemical analysis of essentially nonradioactive Na by the Systems Chemistry Section at Pacific Northwest Laboratory are described. The manual is to serve as a laboratory manual, and also to provide a source of background information about the procedures to the chemically oriented scientists and engineers who submit samples. Improvements in the analytical chemistry of Na are being made continually and the methods included in this manual are undergoing evolutionary changes. Major revisions of some sections will be made as better methods become available or as procedures for additional impurities are developed. (P.C.H.)

5 (CONF-700403-(Vol.2), pp 774-87) NEW USE FOR RARE EARTHS. Recht, Howard L.; Ghassemi, Masood; Kleber, Eugene V. (Atomics International, Canoga Park, Calif.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

The effects of pollution of our water environment have become most noticeable in recent years with the degradation of Lake Erie, accelerated eutrophication being one of the most startling examples. A key cause of this problem has been excessive quantities of phosphates in wastewater effluents, from municipal, industrial, and agricultural sources. The principal methods of wastewater treatment currently practiced do not effect any significant removal of phosphates. A novel approach utilizing trivalent rare earth ions as the precipitating cation yields virtually complete removal of simple and condensed phosphates from solution. The effects of pH, and of ratio of cation to phosphate, were studied, and summary data are presented. Using the data from these studies, a process which recycles the rare earth completely was designed; an economic method for phosphate removal is the result. Final solution to the engineering and political problems posed in this type of environment control could thus result in a market for substantial tonnage quantities—for example one 150 mgd plant (which serves a population of one million) could use 140 tons of rare earth oxides annually. (auth)

6 (FOA-4-4432) EXPERIMENTAL TECHNIQUES FOR TRACER ELEMENT ANALYSIS. Andersson, L. H.; Soederlund, R. (Forsvarets Forskningsanstalt, Stockholm (Sweden)). Jun 1970. 22p. (In Swedish). Dep. CFSTI (U. S. Sales Only).

Experimental procedures and equipments aimed to reduce the contamination to acceptable levels are described. The applications are concentrated on spectrochemical trace analysis of plutonium-containing samples. (Sweden)

7 (IS-2327) BIBLIOGRAPHY OF MASS SPECTROSCOPY LITERATURE FOR THE LAST HALF OF 1968 COMPILED BY A COMPUTER METHOD. Capellen, J.; Svec, H. J.; Jordan, J. R.; Sun, R. (comps.) (Ames Lab., Iowa). Nov 1970. Contract W-7405-eng-82. 531p. Dep. NTIS.

The last half of 1968 is covered and 5299 articles of interest to mass spectroscopists are listed. There are three sections; a bibliography section, an author index section, and a key word out of context index (KWOC Index) section. The Bibliography section lists the authors, the title, and the source for each article. The Author Index lists the authors' names and the reference numbers of their articles. The KWOC Index lists the key words, the reference numbers of the articles in which the key word appears, and the first 100 characters of the title. (auth)

8 (KFK-1144) IN-LINE POLAROGRAPHY FOR URANIUM DETERMINATION IN PROCESS WASTE SOLUTION. Baumgaertel, G.; Thiele, D.; Radek, S. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie). Jul 1970. 20p. (In German). Dep. NTIS (U. S. Sales Only).

For the determination of uranium in highly active waste from

the Purex Process, on-line polarography was developed. It is of use in the region of 10^{-4} to 10^{-3} mole U/liter and 1.0 to 2.0 mole HNO_3/liter to determine uranium concentrations with an accuracy of better than ±10%. Disturbances by foreign ions were removed by automatic addition of supplementary solutions. With an inactive model process solution, the apparatus worked satisfactorily in a 14-day trial run. (tr-auth)

9 (NRL-7146) PROCEDURES FOR THE ANALYSIS OF METALS, ALLOYS, AND OTHER MATERIALS OF RESEARCH. PART 5. AN INVESTIGATION OF THE CHEMICAL ANALYSIS OF CADMIUM-ZINC ARSENIDE. Gates, O. R.; Black, R. W. (Naval Research Lab., Washington, D. C.). 26 Jun 1970. 22p.

Cadmium-zinc arsenide has been analyzed by a combination of chemical and instrumental techniques. After the initial removal of arsenic by distillation, cadmium and zinc are determined by a combined gravimetric and atomic absorption spectrophotometric procedure or by a polarographic procedure. The experimental procedures for determining each of the three major constituents are given in detail. Methods used for checking the effectiveness of their respective separation are also discussed. (auth)

10 POLAROGRAPHIC DETERMINATION OF RUTHENIUM BY MEANS OF A CATALYTIC HYDROGEN WAVE. Buckley, J. P. (Radiochemical Centre, Amersham, Eng.). Anal. Chim. Acta; 52: 379-81(Nov 1970).

A method is described for quantitative ruthenium determination at cell concentrations down to 20 ng ml^{-1} after the ruthenium is converted reproducibly to a nitrosyl chloro complex. (M.C.G.)

11 INDIRECT INVERSE-VOLTAMMETRIC DETERMINATION OF ELEMENTS BY MEANS OF DISPLACEMENT REACTIONS. PART III. DETERMINATION OF RARE EARTHS. Berge, H.; Drescher, A. (Univ., Rostock, Ger. Institut fuer Metallphysik und Reinstmetalle, Dresden). Anal. Chim. Acta; 52: 363-71(Nov 1970). (In German).

The indirect determination of rare earth elements by inverse voltammetry is possible by displacement reactions. This displacement of zinc from Zn-diethylenetriaminepentaacetic acid complexes and Zn-ethylenediaminetetraacetic acid complexes is used for the determination of lanthanum, neodymium, samarium, dysprosium, and lutetium. Zinc is displaced quantitatively from Zn-DTPA by rare earth elements. With Zn-EDTA the reaction is quantitative only with rare earth elements of high atomic number, unless ammonia is present. Methods for the determination of the sum of all rare earth elements and for the determination of a single rare earth element in the concentration range between 10^{-7} and 10^{-4} M are discussed. (auth)

12 STUDY OF METHODS FOR SPECTROGRAPHIC ANALYSIS OF ISOTOPES. Zhiglinskii, A. G.; Kalmakov, A. A.; Fafurina, E. F. (Leningrad State Univ.). Zh. Anal. Khim.; 25: 1297-1300(Jul 1970). (In Russian).

A correlation method for optical mass spectrometry is suggested. In this method the information on the shape of the isotope lines contour is used for determining the isotopic composition. As an example, the error of measuring the relative intensities of the lines of magnesium isotopes is decreased several times. The relative intensities of the lines of magnesium isotopes can be determined with a relative square error of 0.7 to 1.0%. (auth)

13 USE OF N-CINNAMOYLPHENYLHYDROXYLAMINE FOR THE AMPEROMETRIC TITRATION OF NIOBIUM. Gallai, Z. A.; Nifontova, N. V.; Litvak, N. B.; Sheina, N. M. (Moscow State Univ.). Zh. Anal. Khim.; 25: 1337-41(Jul 1970). (In Russian).

The behavior of N-cinnamoylphenylhydroxylamine on graphite and mercury dropping microelectrodes has been studied. Well-defined waves of the oxidation and reduction of the reagent were observed within a wide range of acidities. A method has been developed for the amperometric titration of niobium using a graphite microelectrode. From 50 to 400 μg/ml of niobium can be titrated in 10 to 11 N HCl as a supporting electrolyte in the presence of 300-times its amount of Ni, Co, Zn, Al, Mn(II), Cr(III), Cu; 30-times its amount of Fe(III). Interference is caused by Ta, Ti, Zr, Mo, and W. (auth)

14 EXTRACTION-PHOTOMETRIC METHOD FOR DETERMINING NIOBIUM AS A 2-BENZYLAMINOPYRIDINE-NIOBIUM-THIOCYANATE COMPLEX. Pilipenko, A. T.; Eremenko, O. M. (Kiev State Univ.). Zh. Anal. Khim.; 25: 1330-6(Jul 1970). (In Russian).

Niobium reacts with 2-(benzylamino)pyridine (BAP) in the presence of thiocyanate in a hydrochloric acid medium. Optimum conditions for the formation of a three-component niobium complex have been found. The composition of the complex $(BAP)_2[Nb(SCN)_3X_4]$ has been established by the equilibrium shift method. The molar extinction coefficient of the complex is 35,000 at λ_{max} = 400 nm, which permits the use of BAP as a reagent for determining niobium. The reaction of BAP with thiocyanates of titanium, tantalum, molybdenum, tungsten, iron, and other elements under the same conditions as the niobium determination has been studied. A method for determining niobium with BAP and thiocyanate in steel is suggested. The possibility of determining niobium in the presence of titanium and tantalum has also been examined. (auth)

15 DETERMINATION OF EUROPIUM(III) IN BORATE GLASSES. Reisfeld, Renata; Greenberg, Esther (Hebrew Univ., Jerusalem). Anal. Chim. Acta; 47: 155-8(1969).

Studies were made on the fluorescence of Eu-activated sodium borate glasses as a function of Eu concentration, and the value of fluorescence measurement of these glasses was established as a tool for their analysis. The method was developed for sodium borate glasses, but could be used, with possible modification, for other glasses also. It was concluded that the best procedure for the determination of Eu(III) in borate glasses is the measurement of the emission at 617 nm with excitation at 395 nm. (P.C.H.)

16 SPECTROPHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF TITANIUM IN ZIRCONIUM, ZIRCONIUM ALLOYS, HAFNIUM, NIOBIUM, AND OTHER METALS, WITH DIANTIPYRINYLMETHANE. Wood, D. E.; Jones, J. T. (Imperial Metal Industries Ltd., Birmingham, Eng.). Anal. Chim. Acta; 47: 215-24(1969).

The reaction between titanium and diantipyrinylmethane to form a yellow-colored complex in mineral acid solution has been successfully applied to the direct spectrophotometric determination of titanium over the range 20 to 250 ppM, in Zr, Zr alloys, and Hf. Absorbance of the complex is measured at 390 nm. The proposed method is more sensitive than the peroxide method usually used for determining titanium in these materials. It is also less subject to interference from other metal ions, and can be applied to Zr 30 alloy without preliminary separation of molybdenum. Simple modifications have enabled the procedure to be extended to the determination of titanium in niobium, tantalum, tungsten, and molybdenum. In the analysis of materials containing appreciable amounts of niobium or molybdenum, absorbances are measured at 430 nm. (auth)

17 SOME CONSIDERATIONS ON THE DETERMINATION OF HAFNIUM IN ZIRCONIUM AND ITS ALLOYS BY X-RAY FLUORESCENCE. Vos, G. (CCR, Ispra, Italy). Anal. Chim. Acta; 47: 243-9(1969). (In French).

The determination of hafnium in zirconium and its alloys by x-ray fluorescence is possible down to about 10 ppM if a range of suitable standards is available. Either Hf $L\alpha$ or Hf $L\beta_1$ can be used as the analytical line. The optimal experimental conditions are defined by means of statistical criteria. (auth)

18 DETERMINATION OF NITROGEN IN URANIUM NITRIDE BY THE DUMAS TECHNIQUE. Tolk, A.; Plakman, J. C.; Lingerak, W. A.; Kout, A. (Reactor Centrum Nederland, Petten, Netherlands). Anal. Chim. Acta; 47: 373-6(1969).

A modification of the Dumas method for the determination of N in UN is described. A temperature of 1100°C was found to be necessary to obtain complete recovery of the nitrogen from UN. The results obtained at this temperature were so good that the generally used Pregl-type nitrometer became the limiting factor for the precision of the analysis. For this reason, the absorption chamber of the Pregl nitrometer was replaced by a separate vessel wherein the potassium hydroxide solution could be stirred. The measuring tube of the nitrometer was replaced by a piston burette. A significant increase in precision was obtained by thermostatting the absorption vessel and burette with water mantles, so that errors caused by ambient temperature fluctuations and by heat generated during the absorption were eliminated. The method is not restricted to the analysis of UN but can be used in all cases where CO_2 is able to liberate nitrogen quantitatively from the sample. (P.C.H.)

19 ACCURATE SILICATE ANALYSIS BASED ON SEPARATION BY ION-EXCHANGE CHROMATOGRAPHY. Strelow, F. W. E.; Liebenberg, C. J.; von S. Toerien, F. (National Chemical Research Lab., Pretoria). Anal. Chim. Acta; 47: 251-60 (1969).

A method is presented for the accurate determination of the major and some minor elements in silicate minerals. After sample dissolution and removal of silica, the elements are absorbed from an oxalic-hydrochloric-sulfuric acid mixture on a column of AG1-X8 anion-exchange resin in the oxalate-chloride-sulfate form and a column of AG50W-X8 cation-exchange resin in the hydrogen form. The columns are connected in series. Fe(III), Al(III), Ti(IV), Zr(IV), V(IV), and Mo(VI) are retained by the anion-exchange column, while Mg(II), Ca(II), K(I), Na(I), and

XUM

Mn(II) pass through and are retained by the cation-exchange column. Phosphate passes through both columns. The columns are disconnected and both groups of elements completely separated by using only the volatile inorganic acids, hydrochloric and nitric acid, and the solvents ethanol and acetone as eluents. Selected titrimetric, spectrophotometric, and atomic absorption methods are used for determinations. Very accurate results of analysis of synthetic mixtures and standard rocks are presented together with anion-exchange distribution coefficients in hydrochloric–oxalic acid mixtures and relevant elution curves. (auth)

20 DETERMINATION OF LEAD IN URINE BY ATOMIC ABSORPTION SPECTROPHOTOMETRY AFTER COPRECIPITATION WITH THORIUM. Zurlo, N.; Griffini, A. M.; Colombo, G. (Univ., Milan). Anal. Chim. Acta; 47: 203-8(1969).

Lead is determined in urine by atomic absorption spectrophotometry after separation by coprecipitation with thorium, in the presence of copper(II); concentration of lead and removal of interferences are achieved simultaneously. Fresh urine, or samples acidified with hydrochloric acid, must be used. Precipitation is quantitative from the urine of subjects excreting coproporphyrins or treated with chelating agents, as the added copper liberates the chelated lead. The precision of the method is ±0.005 ppM of lead. (auth)

21 DETERMINATION OF ANTIMONY, IRON, AND MOLYBDENUM IN NICKEL OR URANIUM BY ATOMIC ABSORPTION SPECTROSCOPY. Walker, C. R.; Vita, O. A.; Sparks, R. W. (Goodyear Atomic Corp., Piketon, Ohio). Anal. Chim. Acta; 47: 1-7(1969).

The application of atomic absorption to the microdetermination of antimony, iron, and molybdenum in nickel and uranium is described. These elements are separated and concentrated by a single solvent extraction from 8N hydrochloric acid into n-amylacetate. The extract is then analyzed directly by atomic absorption techniques. For the 95% confidence interval, the limits of error per analysis at the 1-ppM level are ±4, ±10, and ±6% for antimony, iron, and molybdenum, respectively. In general, the procedure described is more rapid and yields more accurate results than colorimetric procedures for these elements. Since the amyl acetate–hydrochloric acid solvent extraction system can separate antimony, iron, and molybdenum from gross quantities of nickel or uranium (i.e., up to 25 g), the method is capable of detecting the elements at about 0.05 μg/g. (auth)

22 DETERMINATION BY ATOMIC ABSORPTION SPECTROPHOTOMETRY OF TRACES OF IRON, NICKEL, AND CHROMIUM IN PLUTONIUM NITRATE SOLUTIONS WITHOUT PRELIMINARY SEPARATION. Ganivet, M.; Benhamou, A. (Centre d'Etudes Nucleaires, Cadarache, France). Anal. Chim. Acta; 47: 81-90(1969). (In French).

Rapid determinations of traces of iron, nickel, and chromium in aqueous plutonium nitrate solutions, without prior separation, are described. These methods can be used in the 0.1 to 8 μg ml^{-1} range for plutonium nitrate solutions containing up to 100 g Pu l^{-1} with a precision better than 5%. The effects of plutonium concentration and interference between the three elements are discussed. In order to apply atomic absorption spectrophotometry to strongly radioactive solutions, a system of glove boxes has been designed. The method can be successfully applied to the analysis of plutonium recovery solutions in fuel-reprocessing plants. (auth)

23 RAPID PROCEDURE FOR PREPARING GAS SAMPLES FOR ^{15}N DETERMINATION. Ross, P. J.; Martin, A. E. (CSIRO, St. Lucia, Australia). Analyst; 95: 817-22(Sep 1970).

A method, which is faster and more convenient than previous techniques, is described for converting ammonium sulphate into nitrogen gas for isotopic analysis on a mass spectrometer. The dry ammonium sulphate sample is contained in a small screw-topped vial, in which it can be stored pending analysis. This vial can be coupled with a neoprene O-ring to a special assembly, evacuated, and the sample oxidised with air-free hypobromite solution from a reservoir in the assembly. By using this procedure the usual inconvenience of de-greasing ground-glass joints on sample tubes is avoided, the difficulty of storing samples prior to analysis is overcome and the de-gassing of solutions prior to the conversion of each sample into nitrogen gas is eliminated. The procedure is particularly suitable when many hundreds of samples are to be analysed. (auth) (UK)

24 STUDIES ON THE ANALYTICAL CHEMISTRY OF HAFNIUM AND ZIRCONIUM. II. FLUORIMETRIC DETERMINATION OF HAFNIUM IN THE PRESENCE OF ZIRCONIUM BY USING QUERCETIN. Brookes, A.; Townshend, A. (Univ. of Birmingham, Eng.). Analyst; 95: 781-5(Sep 1970).

Hafnium (greater than 0.3%) in hafnium–zirconium mixtures can be determined by measuring the fluorescence of the hafnium complexes with quercetin or morin in 57.5% perchloric acid. The zirconium complex with quercetin does not fluoresce, and that with morin fluoresces only weakly at this acidity. Iron, titanium, vanadium, uranium, and molybdenum interfere. A mechanism for the selective fluorescence reaction is suggested. (auth) (UK)

25 DETERMINATION OF ZIRCONIUM AND THORIUM BY SPECTROPOLARIMETRIC TITRIMETRY USING D-(-)-1,2-PROPYLENEDIAMINETETRAACETIC ACID. Caldwell, D. L.; Reinbold, P. E.; Pearson, K. H. (Texas A and M Univ., College Station). Anal. Lett.; 3: 93-102(Feb 1970).

A direct spectropolarimetric titration method of analysis was developed for zirconium and thorium with the stereospecific ligand D-(-)-1,2-propylenediaminetetraacetic acid (D(-)PDTA). The optical rotation of the solution was monitored with a photoelectric polarimeter to determine the end point of the titration. The titrant and the metal complex formed are optically active and serve as self-indicators. The observed optical rotation is linear with respect to the concentrations of the metal complex and the titrant; consequently graphical straight line extrapolations are performed to determine the end point. Particular advantage of the spectropolarimetric titrimetric technique is illustrated by the analysis of zirconium, which was analyzed directly at ambient temperatures. (auth)

26 POTENTIOMETRIC DETERMINATION OF PLUTONIUM IN THE PRESENCE OF URANIUM. Nakano, Hiromasa; Ohnishi, Koichi; Ohuchi, Yoshifusa (Power Reactor and Nuclear Fuel Development Corp., Tokai, Japan). Jap. Anal.; 19: 1293-6 (Sep 1970). (In Japanese).

A modification of Waterbury–Metz's method (Anal. Chem., 31: 1144 (1959)) for the determination of plutonium has been proposed. Perchloric acid was used for the oxidation to Pu(VI) in the method, which, however, was dangerous for handling in plastic gloveboxes. Corpel (Anal. Chim. Acta, 35: 508 (1966)) applied argentic peroxide, but it was unstable. It was found that ammonium persulfate and silver nitrate is an effective oxidizer which is safely handled in plastic gloveboxes. Sulfuric acid (3M) is conveniently used as an eluting reagent in the anion exchange technique when separation of plutonium from metallic impurities is necessary. Interfering action of Pb and Th for the plutonium determination is pointed out in addition to the known interfering elements, Cr, Mn, V, and Pt. (auth)

27 MASKING OF COPPER AND TUNGSTEN IN PHOTOMETRIC DETERMINATION OF MOLYBDENUM IN IRON AND STEEL. Maekawa, Shizuya; Kato, Kiyotoshi; Sasaki, Akira (Japan Steel Works, Ltd., Hokkaido, Japan). Jap. Anal.; 19: 1275-7(Sep 1970). (In Japanese).

A method for the masking of copper and tungsten in the photometric determination of molybdenum in iron and steel with thiocyanate has been studied. The interfering copper is masked with thiourea solution and tungsten with phosphoric acid, although the former is unsuccessful in cases of stannous chloride reduction. The established method using L-ascorbic acid as a reducing agent is described. The sample (0.1~ 0.5 g) is decomposed by treatment with perchloric acid and evaporated to vigorous fumes. After cooling, it is diluted exactly to 100 ml with water, and an aliquot containing not more than 300 μg of molybdenum is transferred to a 50 ml volumetric flask. To it are added 10 ml of perchloric acid, 2 ml of sodium thiocyanate solution (30%), 10 ml of L-ascorbic acid solution (5%), and 5 ml of thiourea solution (10%), and it is diluted exactly to 50 ml with water. The absorbance is measured at 460 mμ against water. Samples containing large amounts of tungsten (for example, high speed steel) are decomposed by using 20 ml of aqua regia, 5 ml of phosphoric acid, and 0.5 g of ammonium bifluoride, and evaporated to fumes with 20 ml of perchloric acid. (auth)

28 SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM IN IRON AND STEEL WITH PYROCATECHOL VIOLET AND ANILINE AFTER EXTRACTION WITH TRI-N-OCTYLPHOSPHINE OXIDE. Kajiyama, Rokuro; Senuma, Kazuhiko (Nippon Yakin Kogyo Co., Ltd., Kawasaki, Japan). Jap. Anal.; 19: 1163-8(Sep 1970). (In Japanese).

The sample was taken up completely with aqua regia and hydrofluoric acid and heated to fumes with perchloric acid. Chromate was reduced with sodium nitrite. The solution was made to 7N nitric acid and zirconium was extracted into 5 ml of TOPO (0.05M)–toluene. The organic layer was washed with 7N nitric acid to remove iron etc., and its aliquot containing 5 ~ 20 μg of Zr was taken into a dried volumetric flask. Three milliliters of 0.1% PCV solution and 4 ml of aniline were added to develop color, and the mixture was diluted to the mark with anhydrous ethanol. The absorbance at 655 mμ was measured against the reagent blank by using an infrared phototube from which the amount of zirconium

was calculated. Diverse elements in steels did not interfere, except for more than 10% of W which slightly reduced the absorbancy. Especially, less than 4% of Zr in niobium steel was readily determined, which had been difficult to determine by the conventional method. The molar absorbancy was 5.00×10^4, which showed higher sensitivity than the determination in an aqueous phase by the same reagent. The proposed method was more practical than the pyridine method with cyclohexane extraction. (auth)

29 ANALYTICAL APPLICATIONS OF X-RAY EXCITED OPTICAL FLUORESCENCE SPECTRA. I. DETERMINATION OF RARE EARTH ELEMENTS IN URANIUM AND ZIRCONIUM. Nakajima, Tokunosuke; Ouchi, Yoshihiko; Kawaguchi, Hiroshi; Takashima, Kyoichiro (Japan Atomic Energy Research Inst., Tokai). Jap. Anal.; 19: 1183-90(Sep 1970). (In Japanese).

A rapid and quantitative method for the analysis of gadolinium, dysprosium, europium, and samarium in uranium and zirconium is described. The method, x-ray excited optical fluorescence, uses high-energy x rays to excite the rare earth impurities in appropriate matrices. The excited rare earth impurities fluorescence with simple line emission spectra which can be used for quantitative measurements. The rare earths were coprecipitated with thorium carrier from an acid solution as ThF_4-NH_4F and thus separated from large amounts of uranium or zirconium. The separated thorium carrier was purified and finally converted to thorium oxide. Terbium was added as a "control" for the recovery of other rare earths. These oxides were then irradiated with x rays and emitted fluorescence spectra were used for the determination of rare earth elements. Added terbium was also used as an "internal standard" for the intensity measurements. The limit of detection for gadolinium and europium was 5 ppB and that for dysprosium and samarium was 20 ppB. (auth)

30 DETERMINATION OF TRACES OF SCANDIUM IN BLOOD. Tszyu, N. P.; Bocharova, R. I.; Men'kov, A. A. (Second Moscow Medical Inst.). Lab. Delo; No. 5, 275-8(1969). (In Russian).

Blood (5 g) was dried at 180° for 2 hr then calcined at 250° (2 hr), 300° (2 hr), 400° (1 hr), 500° (1 hr), and 700° (2 hr). The residue was treated with hot concentrated HCl for 2 hr, then evaporated to 3 ml, and diluted to 10 ml with H_2O. To this solution 5% aqueous ascorbic acid (4 ml) was added, the solution was adjusted to pH 2.35 by adding N–Na acetate, then 0.2% Xylenol Orange (2 ml) was added and the solution was diluted to 50 ml with buffer solution (pH 2.35). After 1 hr, the extinction of the solution was measured at 540 to 560 nm against a reagent blank. The result was referred to a calibration graph prepared with the use of a solution containing (per ml) 1 to 2 μg of Sc and ascorbic acid (4 mg), NaH_2PO_4 (0.16 mg), Fe^{2+} (50 μg), Zn^{2+} (1 μg), Cu^{2+} (0.1 μg), Al^{3+} (0.1 μg), Mn^{2+} (0.01 μg), and Co^{2+} (0.007 μg). The method was sensitive to 20 μg of Sc in 5 g of blood. Results were accurate to within ±15%. (Anal. Abstr.)

31 EVALUATION OF LOW-TEMPERATURE ELECTRON PARAMAGNETIC RESONANCE IN ANALYTICAL CHEMISTRY. Moyer, E.; Guilbault, G. (Louisiana State Univ., New Orleans). Anal. Chim. Acta; 52: 281-6(Nov 1970).

An evaluation of low-temperature electron paramagnetic resonance was completed and the possibility of enhanced quantitative lower limits of detection is discussed. By lowering the temperature of the cavity, the Q-factor is considerably increased producing a more efficient system. Also, the relaxation time is optimized by decreasing the temperature of the sample. Different temperatures for each system produced a maximum signal owing to a combination of detection for these metal ions, the analytical curves were run at the optimum temperature for each system. These data were compared to the data obtained at room temperature. Also, the instrumental parameter effects were evaluated. The metal ions investigated were copper(II), manganese(II), titanium(III), vanadium(IV), chromium(III), gadolinium(III), and iron(III). (auth)

32 DYNAMIC MASS SPECTROMETRY. VOLUME 1. The Second European Symposium on the Time-of-Flight Mass Spectrometer, Salford, England, July 7–11, 1969. Price, D.; Williams, J. E. (eds.). Salford, Eng.; Heyden and Sons Ltd. (1969). 247p. (CONF-690723).

Seventeen of the papers presented at the conference are given divided into four sections: kinetic studies, ionization processes, analytical applications, and general and instrumentation. A separate abstract was prepared for each of two papers. (UK)

For abstracts of individual papers see: 171 and 792.

33 PHOTOMETRIC DETERMINATION OF RUTHENIUM WITH 3-NITROSO-2,6-PYRIDINEDIOL. McDonald, Curtis W.; Bedenbaugh, John H. (Southern Univ. Baton Rouge, La. Univ. of Southern Mississippi, Hattiesburg). Mikrochim. Acta.; No. 3, 612-15(1970).

A highly sensitive photometric method was developed for the determination of ruthenium. The method is based on the purple-colored complex formed when ruthenium is heated with 3-nitroso-2,6-pyridinediol in slightly acidic solution. The molar absorptivity of the purple complex is 2.6×10^4 l mole^{-1} cm^{-1}. The reaction ratio is 3:1 reagent to ruthenium. (auth)

34 EXTRACTIONS WITH LONG-CHAIN AMINES. I. EXTRACTION OF SOME METAL–XYLENOL ORANGE COMPLEXES INTO METHYLTRIOCTYLAMMONIUM CHLORIDE (ALIQUAT 336-S). Pribil, Rudolf; Vesely, Vladimir (J. Heyrovsky Polarographic Inst., Prague). Talanta; 17: 801-5 (Sep 1970).

The extraction of traces of metals forming intensely colored complexes with Xylenol Orange in acidic medium (pH 0 to 3) was studied. For such extractions in the presence of sulphates, chlorides, and nitrates, a solution of methyltrioctylammonium chloride (Aliquat 336-S) in chloroform was used. It is shown that it is possible to detect small amounts of gallium in indium and vice versa, and titanium or zirconium in thorium. These reactions should be capable of adaption to spectrophotometric determinations. The principle of the extraction of metals as their complexes with various metallochromic indicators is briefly discussed. (auth) (UK)

35 SEPARATION AND DETERMINATION OF SIXTEEN METAL IONS BY RADIAL PAPER CHROMATOGRAPHY. Barbiroli, G.; Lipparini, L. (Univ., Bologna). Rass. Chim.; 21: No. 2, 69-75(1969).

By using the technique previously described (Analyt. Abstr. 1965, 12, 4089) ions of the following metals were separated—Mo(II), Pt(II), Sb(III), Ni(II), V(V), As(III), Pd(II), Cu(II), Ti(IV), Mn(II), Co(II), Cd, Hg(II), Zn, Bi(III), and Sn(II). The procedure consists of placing 10 to 20 μl of aqueous solution containing 5 to 80 μg of each element at a point 2.5 cm from the center of a 45-cm disc of Whatman No. 1 paper buffered to pH 8 with borate buffer solution; the chromatogram is developed for 14 hr with ethyl methyl ketone–acetic acid–H_2O (5:3:2). The paper is dried and sprayed on both sides with 0.02% dithizone in CCl_4 followed by 1% diphenylcarbazide in 96% ethanol. The spraying is repeated in the same order. The sensitivity of detection varies from 0.5 μg for Zn to 8 μg for Pb. Semi-quantitative results (7 to 8% error) can be obtained by cutting out and weighing the colored areas. More accurately (<2% error), the cut-out zones are extracted with acetone (5 ml) for 5 to 6 hr and the color of the extract is measured spectrophotometrically at the wavelength of maximum absorption for the particular element. (Anal. Abstr.)

36 S-CARBAMYLTHIOGLYCOLARYLIDES [RING-SUBSTITUTED 2-(CARBAMOYLTHIO)ACETANILIDES] AS REAGENTS FOR INORGANIC CATIONS. Yakubich, V. I. Farm. Zh.; No. 1, 22-5(1969). (In Russian).

Nineteen such compounds were found to be suitable as group reagents for the ions of Co(II), Cd, Ni(II), Cu(II), Pd(II), Ag, and Pt(IV). One of the compounds permitted detection of Cu in concentrations down to 0.03 μg per ml, another the detection of Ni and Pd in concentrations down to 0.3 and 0.7 μg per ml, respectively, and a third the detection of Cu in concentrations down to 0.64 μg per ml. Characteristic and sensitive reactions were also obtained with In, Th, and Hg(II). (Referativny. Zh.)

Isotope Dilution Procedures

37 (NBS-TN-506) ANALYTICAL MASS SPECTROMETRY. Summary of Activities, July 1968–June 1969. Shields, William R. (ed.) (National Bureau of Standards, Washington, D. C.). May 1970. 55p. GPO $0.55.

The advances in instrumentation and the research activities of the Analytical Mass Spectrometry Section during the period July 1968 to June 1969 are described. Chemical and mass spectrometric procedures are described for the determinations of the absolute isotopic abundance ratios of natural rubidium, boron in a natural boric acid and a ^{10}B-enriched boric acid, and of uranium in six Standard Reference Material steels. Procedures are also described for the determination of trace amounts of copper and lead in steel, and silver, copper, boron, and uranium in glass by isotope dilution mass spectrometry. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 216, 247, 269, 355, 356, 364, 377, 408, 458, and 518.

38 (BHO–69-1) PLANT INSTRUMENTATION PROGRAM. Quarterly Progress Report, April–June 1970. (Nuclear

Materials and Equipment Corp., Apollo, Pa.). Contract AT(30-1)-69. 27p. Dep. NTIS.

Methods were standardized and evaluated for plutonium-contaminated wastes and fuel fabrication scrap. The methods studied were passive γ-spectrometric measurements and passive measurements of both total neutrons and coincident fission neutrons. (M.C.G.)

39 (DP-Report-324) DETERMINATION OF FISSION PRODUCT ACTIVITIES IN GRAPHITE BY GAMMA SPECTROMETRY. Project DRAGON. Paul, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf); Blomstrand, J. H. (Atomic Energy Establishment, Winfrith (England)). Mar 1965. 30p. (CONF-641031-7). Dep. NTIS.
From Symposium on Basic Research, Harwell, Eng.

A nondestructive technique is described for the determination of fission products and activation isotopes in graphite. The method is based on scintillation spectrometry and computer analysis of the gamma spectra. Graphite samples from Dragon loop experiments were analyzed and the results agree with figures obtained by radiochemical analysis of similar samples. The methods were applied for determination of spatial distributions of fission products in the Pluto 5 and 6 fuel tubes. (auth)

40 (IDO-12073, pp 28-36) ANALYTICAL CHEMISTRY BRANCH. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

Routine analytical chemistry activities are described. These include analyses of environmental samples obtained during routine surveillance. During the past year, over 21,000 analyses were made on some 14,000 samples of many different types, and 492 direct in vivo measurements on humans were made. The analyses, most of which were made at extremely low levels, included most of the fission products, the transuranium elements, and the heavy element daughters of the naturally occurring series. (P.C.H.)

41 (JAERI-Memo-4106) DETERMINATION OF URANIUM CONTENT OF THE U-Al ALLOY BY DETECTING FISSION NEUTRONS. Ohno, Yoshihisa; Okamoto, Koichi; Ohtomo, Shoichi (Japan Atomic Energy Research Inst., Tokyo). Aug 1970. 19p. (In Japanese). Dep. NTIS (U. S. Sales Only).

Fission neutrons, emitted from a highly ^{235}U-enriched U-Al alloy by irradiation of slow neutrons, were detected to determine quantities of ^{235}U in the alloy. The uranium contents of the alloy were determined from the quantities of ^{235}U in a test piece relative to those in a reference sample. An apparatus with ten BF_3 counters annularly arranged for scattering cross-section measurement was adopted for detecting the fission neutrons after a slight modification of the shielding. The quantities of ^{235}U in the enriched U-Al alloy could be determined sufficiently and accurately by this method. (auth)

42 USE OF ^{40}K TO DETERMINE THE TOTAL β-ACTIVITY OF LONG-LIVED FISSION PRODUCTS. Zaduban, M.; Medvid, A. (Safarik Univ., Kosice, Czech.). This paper was summarized in At. Energ. (USSR); 24: 464(May 1968) as paper No. 204. (In Russian).

Formulas are given for the determination of total β activity of mixtures of long-lived fission products by using ^{40}K standards. Both external and internal standard methods are described. (B.L.M.)

43 DETERMINATION OF LOW LEVELS OF ^{60}Co IN ENVIRONMENTAL WATERS BY LIQUID SCINTILLATION COUNTING. Claassen, H. C. (Geological Survey, Denver). Anal. Chim. Acta; 52: 229-35(Nov 1970).

A method for determination of ^{60}Co in waters at levels greater than 0.5 pCi per sample is presented. A modification of the method may be used to analyze fluvial sediments and soils. After the cobalt is separated, first as the hydroxide and then as the thiocyanate complex in methyl isobutyl ketone, it is counted in a liquid scintillation system at 80% efficiency. Separation factors achieved for six isotopes are generally greater than 2000. The time for a single analysis, exclusive of the counting and evaporation operations, is about 2 hr. (auth)

44 MESSUNG RADIOAKTIVER NUKLIDE. (Measurement of Radioactive Nuclides). Baechmann, Knut. Kernchemie in Einzeldarstellungen. Band 2. (Nuclear Chemistry in Monographs, Volume 2). Weinheim, Ger.; Verlag Chemie GmbH (1970). 197p. DM 58,-.

Topics covered include: interactions of radiation with materials, detectors, electronic aids, measurement of different kinds of radiation, determination of half-lives and complex decay curves, energy determinations, measurement arrangements, activity and pulse rates, standards, and dose measurements. (M.C.G.)

45 OPTIMAL CONDITIONS FOR COUNTING OF PRECIPITATED ^{3}H-RNA ON GLASS-FIBER FILTERS. Birnboim, H. C. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Anal. Biochem.; 37: 178-82(Sep 1970).

The use of glass-fiber filters was compared with other methods for counting ^{3}H-RNA precipitates. The high efficiency of the method is demonstrated. (M.C.G.)

46 DETERMINATION OF ^{137}Cs IN IRRADIATED URANIUM. Ishimori, Tomitaro; Kimura, Kan (Japan Atomic Energy Research Inst., Tokai). Jap. Anal.; 19: 1289-91(Sep 1970). (In Japanese).

Cesium-137 in irradiated uranium samples was separated from the other fission products with 10 mg isotopic carrier by using connected columns of silica gel and Ionite C (zirconium phosphate), and was determined by γ counting whereby the chemical yield was measured by precipitating and weighing of cesium tetraphenyl borate. 10 ml of 2N nitric acid solution of the sample is passed with 10 mg Cs carrier through silica gel-Ionite C columns (volume: 3 ml each), and the column is washed with 6 ml of 2N HNO_3. The Ionite C column is disconnected from the silica gel column, washed with 15 ml of 2N HNO_3 and with 5 ml of 6N HNO_3. The Cs absorbed on the Ionite C column is eluted with 10N HNO_3, evaporated, and the residue is taken up with 1N HNO_3. Cs is precipitated three times as tetraphenyl borate. The sample is weighed and the γ activity is measured. The recovery test proved that the error was within ±3% and the decontamination factor of Cs from the other fission products at the column separation step alone was $>2 \times 10^4$. (auth)

47 DETERMINATION OF PLUTONIUM IN SOIL SAMPLES. Inoue, Yoshikazu; Sakanoue, Masanobu (Kanazawa Univ., Japan). J. Radiat. Res.; 11: 98-106(Jun 1970).

The content of ^{239}Pu in soil was determined by using ^{238}Pu as yield tracer. The samples were decomposed by nitric acid treatment under ultrasonic vibration and the separation of plutonium from other elements was carried out by using anion exchange resin. Surface soils showed plutonium contents of about 1 to 4 mCi/km^2 and their ^{239}Pu/^{90}Sr activity ratios were 2 to 5%. From these results, it was concluded that ^{239}Pu in soil at present results mainly from the fallout due to nuclear bomb test explosions. (auth)

Activation Procedures

Refer also to abstract 797.

48 (CSIRO-Trans-10089) SENSITIVITY OF THE ACTIVATION ANALYSIS ON SHORT-LIVED ISOTOPES. Leushkina, G. V.; Lobanov, E. M.; Dutov, A. G.; Matveeva, N. P. Translated by R. J. Zatorski (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia), from At. Energ. (USSR); 26: 381-3(Apr 1969). 3p. Dep. NTIS (U. S. Sales Only).

An abstract of this article, prepared from the original, appeared as NSA 23: 35037. (Australia)

49 (NBS-TN-534) OCEANOGRAPHY: A BIBLIOGRAPHY OF SELECTED ACTIVATION ANALYSIS LITERATURE. Lutz, G. J. (ed.) (National Bureau of Standards, Washington, D. C.). Jun 1970. 36p. GPO $0.50.

Eighty-four references on the use of activation analysis in oceanography are given to journals, conference papers, reports, and preprints published from 1952 through Nov. 1969. Separate indexes are included for author, element determined, matrix analyzed, and technique used. (P.C.H.)

50 COKE OF MBOCAYA. Facetti, J. F. (Univ. Nacional, Asuncion). Rev. Soc. Cient. Paraguay; 8: 25-8(1967). (In Spanish).

The composition of the coal obtained from the endocarpious of Mbocaya was determined by proximate analysis. In addition, some C elemental analysis was done using standard and neutron activation procedures and the heating value calculated or determined. The material corresponds to a bituminous low-volatility coal according to ASTM classification. (auth)

51 DETERMINATION OF IODINE IN THYROID GLAND WITH EPITHERMAL NEUTRONS. Brune, D.; Wester, P. O. (Aktiebolaget Atomenergi, Studsvik, Sweden). Anal. Chim. Acta; 52: 372-3(Nov 1970).

The advantages resulting from the use of epithermal neutron activation analysis of iodine in small thyroid tissue specimens are discussed. For 9 samples the mean value for iodine concentration and its standard error amounted to (671 ± 15) μg g^{-1} of wet tissue. The samples were irradiated in a cryostat in a central reactor channel. (M.C.G.)

52 ACTIVATION ANALYSIS OF MERCURY IN HUMAN URINE SAMPLES. Kim, J. I.; Staerk, H. (Technische Hochschule, Garching, Ger.). Radiochim. Acta; 13: 213-16(Jun 1970).

An activation analytical method was developed for determination of trace amounts of Hg in human urine samples. A special system was introduced for irradiation of many large-volume urine samples in order to get a homogeneous neutron flux in every sample. A quantitative Hg recovery was obtained by introducing a simple chemical separation: destruction of sample, and deposition of Hg on an amalgamated Cu foil. The sensitivity of the method was found to be at 10^{-5} g Hg/5 ml urine. (auth)

53 PRECISION OF OXYGEN DETERMINATIONS IN STEEL BY 14-MeV NEUTRON ACTIVATION. Van Grieken, R.; Speecke, A.; Hoste, J. (Univ., Ghent). Anal. Chim. Acta; 52: 275-80 (Nov 1970).

The precision of the 14-MeV neutron activation determination of oxygen in steel was examined as a function of the oxygen content for a large number of steel and cast iron samples. The experimental and the statistically expected standard deviations were compared. In the conditions used, 2.5 counts from ^{16}N were registered for each ppM of oxygen in the samples. The neutron flux was monitored by a simultaneously irradiated oxygen standard. (auth)

54 DETERMINATION OF FOURTEEN COMMON ELEMENTS IN ROCKS VIA SEQUENTIAL INSTRUMENTAL ACTIVATION ANALYSIS. Schmitt, R. A.; Linn, T. A. Jr.; Wakita, H. (Oregon State Univ., Corvallis). Radiochim. Acta; 13: 200-12(Jun 1970).

Instrumental activation analysis (IAA) in a sequential analytical procedure was developed and applied to the determination of 14 common bulk major and minor elements in a wide variety of rock types, ranging from dunites to granites, and in a variety of stone meteorite specimens. This sequential nondestructive technique consists of 14-MeV neutron (~10^{10} nvt) activation for Si(^{28}Al) and O(^{16}N); thermal neutron (~2×10^9 nvt) for Al(^{28}Al); thermal neutron (~10^{13} nvt) for Na(^{24}Na) and Mn(^{56}Mn); thermal neutron (~10^{14} nvt) for K(^{42}K); 23 MeV bremsstrahlung (~2×10^6 R) for Mg(^{24}Na); 28 MeV bremsstrahlung (~8×10^7 R) for Ca(^{47}Ca), Ti(^{47}Sc) and Ni(^{57}Ni); thermal neutron (~2×10^{15} nvt) for Cr(^{51}Cr), Fe(^{59}Fe), Co(^{60}Co) and Ba(^{131}Ba); all radionuclides were counted by either NaI(Tl) or Ge(Li) detectors. Sc(^{46}Sc) and Cu(^{64}Cu) abundances are obtained in the thermal-neutron activations for the element groups of Cr and K. Elemental abundances agreed with ±1 to 5% of literature values; in some cases, IAA values were considered superior to classical analyses. After IAA for the 14 bulk elements, the rock specimens may be subjected to further chemical and physical measurements. (auth)

55 DETERMINATION OF IMPURITIES IN TITANIUM AND TITANIUM DIOXIDE BY NEUTRON ACTIVATION ANALYSIS. PART III. DETERMINATION OF VANADIUM AND ALUMINUM IN TITANIUM AND TITANIA BY PRESEPARATION. Neirinckx, R.; Adams, F.; Hoste, J. (Ghent Univ.). Anal. Chim. Acta; 47: 173-82(1969).

The determination of vanadium and aluminum by activation analysis was applied to titanium and titania samples. Three preseparation procedures, precipitation of titanium hydroxide, anion-exchange separation, and scavenging with lead fluoride, were examined on different samples. The sensitivity of these methods was higher than for a nondestructive determination. (auth)

56 DETERMINATION OF SULPHUR IN FLUOROCARBON POLYMERS BY NEUTRON ACTIVATION. Heslop, R. B.; Tay, S. K. (Univ. of Manchester, Eng.). Anal. Chim. Acta; 47: 183-8(1969).

Sulfur can be determined in fluorocarbon polymers and other fluorine compounds by neutron irradiation to convert sulfur-32 to phosphorus-32 by the (n,p) reaction. The phosphorus produced is determined by a substoichiometric extraction of vanadomolybdophosphoric acid, followed by measurement of β-emission. The method is satisfactory for sub-milligram quantities of sulphur irradiated for only 8 hr. (auth)

57 DETERMINATION OF MANGANESE IN STEEL BY NEUTRON-ACTIVATION ANALYSIS. Nadkarni, R. A.; Haldar, B. C. (Inst. of Science, Bombay). Indian J. Appl. Chem.; 31: 175-80(1968).

Alloy-steel samples (10 to 65 mg) and $MnSO_4$ standards (140 to 420 μg of Mn) were irradiated in a thermal-neutron flux of ~2×10^{12} neutrons per cm^2 per sec for periods ranging from 1 to 184 hr. The samples and standards were subjected to a chemical separation involving extraction of Fe and Mo into ethyl ether and double precipitation of MnO_2, and the ^{56}Mn activity was measured with a NaI(Tl) detector coupled to a single-channel γ spectrometer at 0.84 MeV, or with an end-window Geiger–Mueller tube. In an alternative non-destructive method, the irradiated sample and standard were allowed to decay for 4 hr and then counted on a single-channel γ analyzer. The base of the photopeak (0.845 MeV) measured after the complete decay of ^{56}Mn (~30 hr) was taken as the activity of steel. Results were comparable with those obtained by the chemical separation method. Even if irradiation time was reduced to a few minutes, sufficient activity was produced for accurate measurements. Interference due to the reactions ^{56}Fe(n,p)^{56}Mn and ^{59}Co(n,α)^{56}Mn can cause errors corresponding to ~0.06% of Mn in the sample. Down to 2 ng of Mn can be determined. (Anal. Abstr.)

58 DETERMINATION OF LANTHANUM, SAMARIUM, EUROPIUM, AND THORIUM IMPURITIES IN NUCLEAR-GRADE URANIUM PRODUCTS. Turkstra, J.; Behrens, G. B.; de Wet, W. J. (Natural Nuclear Research Center, Pelindaba, S. Afr.). J. S. Afr. Chem. Inst.; 22: 111-20(1969).

The procedure, which avoids the usual tedious radiochemical separations, permits determination of ppM concentration of Th and <1 ppM of La, Sm, or Eu. After dissolution of the sample (10 g) in hot HNO_3–HCl (1:3) and addition of Dy carrier (1 mg), the solution is passed through a column (25 cm × 2 cm) of De-Acidite FF resin (30 to 50 mesh) on which only U is quantitatively retained after washing the resin with 9M-HCl. The La, Sm, and Eu in the rare earth fraction are determined, after irradiation of the solution for 5 min in a neutron flux of ~3×10^{13} neutrons per cm^2 per sec, by high-resolution γ spectrometry in an instrument equipped with a Ge(Li) detector. Protactinium-233 (produced by decay of ^{233}Th) interferes in the determination of ^{153}Sm, and is separated, after the irradiation, on a similar but smaller column (10 cm × 0.4 cm); the rare earth metals are eluted with 9M-HCl and the Pa subsequently with 3.5M-HCl. The Th content is found by measurement of ^{233}Pa. Results for concentration of each element down to 0.002 ppM are listed; the sensitivity is ~0.0005 ppM. By using optimum times of irradiation and decay (listed), Nd, Dy, Gd, Tb, Yb, Lu, and Ce can also be determined simultaneously by measurements of their specific photopeaks. Self-shielding by the Dy carrier is not serious. (Anal. Abstr.)

59 DETERMINATION OF ZIRCONIUM IN ALLOYS WITH BERYLLIUM, MAGNESIUM, ALUMINUM, AND NIOBIUM BY PHOTOACTIVATION. Kochevanov, V. A.; Kuznetsov, R. A. This paper was summarized in At. Energ. (USSR); 24: 181-2 (Feb 1968) as paper No. 181. (In Russian).

When Zr is exposed to hard γ radiation, the (γ,n) reaction results in ^{89m}Zr and ^{89}Zr with half-lives of 4.4 min and 79 hr, respectively. However, only ^{89m}Zr is suitable for rapid determination methods since short exposure is required. Radiation products in the other components of the alloys (Be, Mg, and Al) amount to radioisotopes with shorter half-lives. A short time lag before measurement of the irradiated samples results in their complete decay, except for Nb, which forms sufficiently long-lived isotopes and is therefore slightly activated by a short irradiation. Irradiation time was 4 min. The activity measurement was begun 2 min after the end of exposure. The method makes it possible to determine a Zr content of approximately 1 mg and more without any difficulty. With lower content, activated impurities may interfere. The overall time for analyzing one sample by this method is 10 to 15 min. The accuracy of the method for a Zr content of over 5 mg is 5%. (P.C.H.)

60 MODEL AGE DETERMINATION OF KOREAN GALENA BY NEUTRON ACTIVATION. Lee, Chul (Atomic Energy Research Inst., Seoul). J. Nucl. Sci. (Seoul); 10: No. 1, Pt. 1, 41-3(Jun 1970). (In Korean).

Galena samples from Wul-Am Second Mine, Bong–Hwha–Kun, Kyung-Sang-Buk-Do, Korea were irradiated in the central thimble irradiating position of TRIGA MARK-II along with a lead nitrate standard whose isotopic composition was predetermined by mass spectrometry. The isotopic composition ratio, $^{208}Pb/^{204}Pb$, of the galena was determined by comparing both ^{209}Pb radioactivities of galena and standard lead which were produced by ^{208}Pb(n,γ)^{209}Pb reaction and by comparing both ^{204m}Pb γ radioactivities of galena and the standard, which were produced by the ^{204}Pb(n,n')^{204m}Pb reaction. The model age of the galena was determined by the Russel-Farquhar-Cumming Model from the determined $^{208}Pb/^{204}Pb$ ratio [37.6 × 0.8 (1σ)]. The model age determined was 723 (±390) × 10^6 years. (auth)

61 STUDY OF ZINC DISTRIBUTION IN THE HARD TISSUE OF TEETH BY NEUTRON-ACTIVATION ANALYSIS. Maksimovskii, Yu. M.; Glazunov, M. P. Stomatologiya; No. 3, 14-17(1969). (In Russian).

Teeth were cleaned, dried at 150 to 160°, then the enamel and

dentine were separated and samples including a Zn standard were sealed in quartz ampoules. These were irradiated for 100 hr in a neutron flux of $\approx 1.2 \times 10^{13}$ neutrons per cm^2 per sec, set aside for 1.5 to 2 months for decay of ^{24}Na, ^{42}K, and ^{32}P and then the radioactivity of ^{65}Zn was measured at 1120 keV by means of a 256-channel scintillation γ spectrometer with a NaI(Tl) crystal (4 cm × 4 cm) and with the use of plastic and lead filters (5 mm thick) to absorb retarded radiation. The method was used to determine Zn in milk teeth of children and in molars of the aged. (Referativnyi Zh.)

62 DETERMINING NIOBIUM BY ACTIVATION METHODS. Mazitov, B. S.; Mukhammedov, S. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 1, 56-8(1970). (In Russian).

The use of charged particles may be more selective than the use of neutrons in many cases. Comparison with a standard can be used by placing the standard behind the unknown and then irradiating with protons. Thus a niobium impurity in tantalum was determined by irradiating the Ta target with 18-MeV protons, which form ^{93m}Mo by a (p, n) reaction on niobium. The induced ^{93m}Mo activity has a half-life of 7 hours, and emits three cascade gamma quanta with energies of 0.260, 0.690, and 1510 MeV. Hence, coincidence counting can be used to determine the induced ^{93m}Mo activity. The sensitivity of determining niobium was 8.3×10^{-7} g per gram of tantalum sample. (TTT)

Inorganic, Organic, and Physical Chemistry

63 160th NATIONAL MEETING, AMERICAN CHEMICAL SOCIETY, CHICAGO, ILLINOIS, SEPTEMBER 14–18, 1970. ABSTRACTS OF PAPERS. Washington, D. C.; American Chemical Society, Special Issues Sales (1970). 650p. $4.00. (CONF-700911–(Absts.)).

64 ABSTRACTS OF PAPERS OF THE 159th NATIONAL MEETING, AMERICAN CHEMICAL SOCIETY, HOUSTON, TEXAS, FEBRUARY 22–27, 1970. American Chemical Society Publications. Washington, D. C.; Special Issues Sales, American Chemical Society (1970). 247p. $4.00. (CONF-700201–(Absts.)).

Chemical Properties

Refer also to abstracts 249, 682, 736, 744, and 1886.

65 (CONF-700403–(Vol.1), pp 152-63) REACTIONS OF THE SESQUIOXIDES OF Pm, Nd, AND Sm WITH WATER. Fullam, Harold T.; Roberts, Frank P. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The reactions of Pm_2O_3, Nd_2O_3, and Sm_2O_3 with water were investigated. Thermograms were obtained for the reaction products, as well as for the hydroxides of Pm, Nd, and Sm prepared by precipitation techniques. The solubility and dissolution rates of Pm_2O_3 in distilled water and synthetic seawater were determined. (auth)

66 (CONF-700403–(Vol.1), pp 258-65) TRICYCLOPENTADIENYL COMPLEXES OF PROMETHIUM, CURIUM, BERKELIUM, AND CALIFORNIUM: THEIR PREPARATION AND IDENTIFICATION BY MICROTECHNIQUES. Laubereau, P. G.; Burns, J. H. (Oak Ridge National Lab., Tenn.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The compounds $Pm(C_5H_5)_3$, $Cm(C_5H_5)_3$, $Bk(C_5H_5)_3$ and $Cf(C_5H_5)_3$ were synthesized in microgram amounts with techniques specially adapted to the minuteness of the samples. In addition evidence was obtained for the possible formation of a complex $(C_5H_5)_2BkCl$. The existence of the compounds was established by comparison of their x-ray powder patterns with those of the known compounds $Pr(C_5H_5)_3$, $Sm(C_5H_5)_3$, $Eu(C_5H_5)_3$, $Gd(C_5H_5)_3$, and $Tb(C_5H_5)_3$. In case of the tricyclopentadienyls of Pm, Cm, Bk, and Cf further proof of their identity was obtained from single-crystal data. It was also possible to record electronic spectra which will be reported together with other properties of the compounds. (auth)

67 (CONF-700403–(Vol.1), pp 266-76) FORMATION CONSTANTS OF THE RARE-EARTH COMPLEX SPECIES. Suzuki, Yasuo; Mikado, Mariko (Japan Atomic Energy Research Inst., Tokyo).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The formation constants of the rare earth α-hydroxyisobutyrate complex species were determined potentiometrically at 25.0° and 40.0°C and at an ionic strength of 0.10 with sodium perchlorate as a supporting electrolyte. A double-junction calomel reference electrode was used throughout the work in order to minimize the errors due to the formation of slightly soluble potassium perchlorate, resulting in more accurate constants than ever. Both IBM 7044 and FACOM 230-60 computers were employed for the calculations. The constants versus atomic number curve obtained is smoother than the ones previously reported, although two minor breaks are apparently observed at gadolinium and also at neodymium. The constant for yttrium falls between those for dysprosium and holmium, as predicted from their ionic radii. (auth)

68 (CONF-700403–(Vol.1), pp 277-92) DIFFERENT HYDRATED FORMS OF THE ETHYLENEDIAMINETETRAACETATO COMPLEXES OF THE RARE EARTHS. Mackey, J. Linn; Goodney, David E.; Cast, James R. (Austin Coll., Sherman, Tex. Dept. of Chemistry).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

By control of conditions, the reaction between rare earth carbonates and ethylenediaminetetraacetic acid (EDTA) yields different hydrates of the protonated 1:1 rare earth–EDTA chelates. Some of these chelates correspond to those already reported in the literature, while others are new. These chelates have been characterized by chemical analysis, I. R., T. G. A., and x-ray powder diffraction. The stability and structure of the different hydrated forms of these 1:1 chelates are discussed in terms of the ionic radii, coordination numbers of the rare earths and the steric requirements of the chelates. (auth)

69 (CONF-700403–(Vol.2), pp 588-97) REACTION OF SELECTED LANTHANIDE CARBIDES WITH PLATINUM AND IRIDIUM. Krikorian, N. H. (Los Alamos Scientific Lab., N. Mex.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

The dicarbides of yttrium, cerium, and erbium were reacted with platinum and iridium by heating in the range 1000° to 1600°C. The reduction of the carbides leads to the formation of a number of rare earth platinides and iridides and free carbon. No ternary compounds were found. Ternary diagrams were deduced. From the reactions, lower limits can be set for free energy of formation of the intermetallic compounds. (auth)

70 (DP-Report-205) KINETIC MEASUREMENTS OF THE REACTION OF CARBON WITH CARBON DIOXIDE IN A DIFFERENTIAL REACTOR. Project DRAGON. Hedden, K.; Loewe, A. (Muenster Univ. (West Germany). Atomic Energy Establishment, Winfrith (England)). Aug 1963. 20p. (CONF-630605–1). Dep. NTIS.

From Symposium on Graphite Physics, Diffusion, and Carbon Transport, Harwell, Eng.

A recycling system with a differential reactor for heterogeneous reactions is described. For the gasification of carbon with carbon dioxide three different techniques of operation were developed, the closed, the half-open, and the open circuit. The closed circuit was used to find the rate equation as function of CO_2 concentration. Also the inhibition effect of CO could be shown by this method. In the half-open circuit the gas concentrations can easily be held constant, so that the rate can be investigated as function of burn-off only. From such measurements the rule resulted that the relative increase of rate with burn-off is the steeper the lower the burn-off rate is. The half-open technique also proved to be of great value in determining the inhomogeneity of impregnated carbon tubes, because only small quantities of carbon were available for these tests. The open circuit will be used for investigations with very small quantities of oxidizing gases in an inert gas to find out the burn-off rates in a cooling gas for high temperature reactors with small remains of CO_2 and H_2O. (auth)

71 (DP-Report-319) RATE CONSTANTS OF THE REACTION OF CARBON WITH CARBON DIOXIDE. Project DRAGON. Hedden, K.; Loewe, A. (Atomic Energy Establishment, Winfrith (England)). Feb 1965. 30p. (CONF-641031–4). Dep. NTIS.

From Symposium on Basic Research, Harwell, Eng.

The applicability of the Hinshelwood equations was tested by determination of the rate constants for crushed samples of Grade 9 and G.5 graphites. These constants enable the burnoff rates of re-

actor graphite with a small residue of carbon dioxide in the coolant gas to be predicted. The rate dependence of the carbon reaction with CO_2 on concentration and temperature was measured and the method for elimination of the influence of burnoff on reaction rates described. The relationship between surface area and carbon burnoff was investigated. Rate constants were calculated from the data of other workers on the CO_2 gasification of coconut shell charcoal, coke and electrode carbon, and a comparison of rate constants made. The reactivities of Grade 9 and G.5 graphite were compared. (auth)

72 (MLM–1743) EFFECT OF HYDROLYSIS ON THE DISPROPORTIONATION OF TETRAVALENT AND PENTAVALENT PLUTONIUM IONS. Silver, G. L. (Mound Lab., Miamisburg, Ohio). 30 Oct 1970. Contract AT-33-1-GEN-53. 31p. Dep. NTIS.

The concept that equations representing plutonium disproportionation reactions should include three plutonium species as products is expanded to include hydrolysis and complexation. The utility of variable disproportionation stoichiometry coefficients is discussed, and the presence of maxima in the concentrations of Pu(III) and Pu(VI) which are derived via disproportionation is suggested. The appropriateness of earlier studies of the disproportionation of Pu(IV) which neglected the presence of pentavalent plutonium is questioned. (auth)

73 (RD/B/N–1620) STUDIES OF THE RADIATION INDUCED REACTIONS OF WATER VAPOUR AND HYDROGEN WITH PGA GRAPHITE. Bullock, B. L.; Morgan, C.; Swan, T. (Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.). Jun 1970. 22p. Dep. NTIS (U. S. Sales Only).

The reaction of H_2O vapour with PGA graphite was investigated both with and without irradiation. Yields of CH_4, CO, H_2, and C_2 hydrocarbons are reported. Irradiation of the H_2O/graphite system results in a net CH_4 formation at 25°C and a net CH_4 destruction at 400°C. A tentative reaction mechanism is proposed. Preliminary investigations of the radiation induced reactions between CO_2, H_2 and PGA graphite indicate that CH_4 arises from a reaction between H_2 and CO_2. (auth) (UK)

74 SYNTHESES OF ASTATOBENZENE. Samson, G.; Aten, A. H. W. Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Radiochim. Acta; 13: 220-1(Jun 1970).

Seven different methods were investigated for the production of astatobenzene. These were: (1) homogeneous exchange at room temperature of the reaction, $C_6H_5I + AtI \rightarrow C_6H_5At + I_2$; (2) homogeneous exchange of the same reaction above in an intense field of ionizing radiation (bremsstrahlung); (3) synthesis from phenylhydrazine by the reaction $C_6H_5NHNH_2 + AtI + I_2 \rightarrow C_6H_5At + N_2 + 3HI$; (4) synthesis from phenyldiazoniumchloride, $C_6H_5N_2Cl + At^- \rightarrow C_6H_5At + Cl^- + N_2$; (5) thermal decomposition of diphenyldiodonium iodide containing diphenyliodoniumastatide, $(C_6H_5)_2IAt \rightarrow C_6H_5At + C_6H_5I$; (6) heterogeneous exchange at elevated temperatures with At^- (in I^-), C_6H_5I(vapor) + At^-(in solid KI) $\rightarrow C_6H_5At + I^-$; and (7) irradiation of triphenylbismuth with $^4He^{2+}$ particles, $(C_6H_5)_3Bi$ ($^4He^{2+}$, 2n) C_6H_5At + fragments. The products from the various reactions were identified by a radiogaschromatographic method, and in each case a single astatine peak was noted regardless of the method of preparation used. (B.L.M.)

75 FORMATION OF ORGANIC IODINE BY REACTIONS OF IODINE RELEASED FROM IRRADIATED FUEL WITH SEVERAL GASEOUS MATERIALS. Iwamoto, Kazumi; Kikuchi, Teruo (Japan Atomic Energy Research Inst., Tokai). Radioisotopes (Tokyo); 19: 439-45(Oct 1970).

The formation of organic iodine by reactions of iodine released from irradiated U_3O_8 with several materials such as air, CO_2, H_2O, CH_4, and C_4H_{10} and of vaporized AgI with materials such as air, CH_4, and CH_3OH was studied. The formation of the organic iodine was noticed in both cases when the iodine released from the irradiated U_3O_8 reacted with CH_4 or C_4H_{10} gas and when the AgI did with CH_4 gas or CH_3OH vapor. The yield of the organic iodine increased with increases in reaction time and the gas concentration. It was found in case of the irradiated U_3O_8 that the organic iodine was formed predominantly by a gas–solid reaction between CH_4 gas and the iodine deposited on the wall of the reaction space rather than by a gas phase reaction between released iodine in the vapor state and the gas. The yield of the organic iodine increased with increase in the decomposed fraction of the uranium iodide released from the irradiated U_3O_8 or the vaporized AgI. In the cases of air, H_2O, CO_2, the organic iodine formation was thought to be suppressed. (auth)

76 CONVERSION OF URANYL NITRATE TO URANIUM TETRAFLUORIDE. Weinhold, G. (Steinkohlen-Elektrizitaet AG, Essen). Kerntechnik; 12: 338-40(Aug 1970). (In German and English).

Several European companies and institutions founded the Société de Fluoration d'Uranium (SFU). The SFU will operate a plant for the conversion of uranyl nitrate to uranium tetrafluoride at Mol in cooperation with Eurochemic. The conversion process consists essentially of the electrolytical reduction of uranium(VI) to uranium(IV) followed by precipitation of the uranium as uranium tetrafluoride. Conversion of uranyl nitrate to uranium sulfate precedes the electrolysis. (auth)

77 REACTION OF URANIUM AND ITS ALLOYS WITH ALKALI METAL FLUORIDES. Novoselov, G. P.; Kashcheev, I. N.; Dogaev, Yu. D. This paper was summarized in At. Energ. (USSR); 28: 48(Jan 1970) as paper No. 358/5385. (In Russian).

The fluoride method of reprocessing irradiated metallic nuclear fuel involves a large consumption of fluorine and substantial heat evolution. A preliminary conversion of metallic uranium to nonvolatile fluorides (UF_4, UF_3) and their further fluorination to the hexafluoride is expedient. The reaction of uranium with alkali metal fluorides at the temperature 1273°K and above under nonequilibrium conditions was investigated. It was established that uranium reacts with fluoride melts according to the reaction: $U + nRF \rightarrow UF_n + nR$, where R is an alkali metal (lithium, sodium, potassium); n is the valence of uranium (three or four). The processes are accompanied by an evolution of vapors of the alkali metals and the formation of uranium tetrafluoride and trifluoride. With respect to increasing intensity of the reaction with uranium, the alkali metal fluorides are arranged in the following sequence: LiF–NaF–KF. The volatilities of these metals also increase in the same order, which indicates that the removal of their vapors from the reaction zone is a deciding factor. (M.C.G.)

Isotope Effects and Exchange

Refer also to abstracts 161, 197, 248, and 758.

78 ISOTOPE EFFECTS IN THE PHOTOIONIZATION YIELDS AND THE ABSORPTION CROSS SECTIONS FOR ACETYLENE, PROPYNE, AND PROPENE. Person, James C.; Nicole, Paul P. (Argonne National Lab., Ill.). J. Chem. Phys.; 53: 1767-74(1 Sep 1970).

The values of the absorption cross section σ and the photoionization yield η (the probability that photon absorption produces ionization) were experimentally determined for C_2H_2 and C_2D_2, C_3H_4 and C_3D_4, and C_3H_6 and C_3D_6 at various photon energies in the energy range of 11.25 to 11.78, 10.23 to 11.78, and 9.63 to 11.78 eV, respectively. In both propyne and propene there is an increase in ionization for the heavier isotopic molecules, which is evident both in η and in the photoionization cross section, σ_i ($\sigma_i = \eta\sigma$). This increased ionization is discussed in terms of the Platzman competitive ionization mechanism, and the effects of methyl substitution on σ and σ_i are also discussed. (auth)

79 NONEQUILIBRIUM VIBRATIONAL EXCITATION MECHANISM FOR THE REACTION $H_2 + D_2 \rightarrow 2HD$. Poulsen, Lise Lotte (Univ. of Copenhagen). J. Chem. Phys.; 53: 1987-99 (1 Sep 1970).

A reaction mechanism for the four-center exchange reaction $H_2 + D_2 \rightarrow 2HD$ is described in detail. The principal idea is that H_2 and D_2 react with higher probability when the energy present originates in vibrational rather than translational energy. Detailed calculations are presented, which show that the mechanism agrees with available results of shock tube experiments, when experimental rate constants are used for the vibrational relaxation. It is shown that the energy necessary for reaction to occur is about 38 kcal, in addition to the vibrational zero-point energy, and that the main part of the experimental HD yield is formed in elementary reactions, which involve either $D_2^{(2)}$ or $H_2^{(2)}$, where the superscripts are the vibrational quantum numbers. The concentrations of these species are depleted below the equilibrium values, and in this way the mechanism explains the surprising experimental dependence of the reaction rate on the concentration of Ar, which constitutes about 90% of the reaction mixture. It is very plausible that the important elementary reactions are $D_2^{(2)} + H_2^{(1)}$, $D_2^{(2)} + H_2^{(2)}$, and possibly also $D_2^{(1)} + H_2^{(2)}$, where in the latter reaction the translational energy must be at least 8 kcal. H_2, D_2 pairs involving more vibrational energy are too rare to contribute significantly to the reaction. The calculations show that a stationary distribution of the molecules over the vibrational levels should be obtained experimentally within 4% of the time of reaction. The mechanism implies an over-all rate expression of complex form. (auth)

80 MICROWAVE SPECTRUM AND STRUCTURE OF CHLORINE AZIDE. Cook, Robert L. (Duke Univ., Durham, N. C.); Gerry, M. C. L. J. Chem. Phys.; 53: 2525-8(15 Sep 1970).

The microwave spectra of four isotopic species of chlorine azide, ClN_3, were observed in the frequency range 26 to 48 GHz.

From the measured values of the rotational constants, the molecule was deduced to be planar with the following internuclear parameters: $r(Cl-N_{(1)}) = 1.745 \pm 0.005$ Å, $r(N_{(1)}-N_{(2)}) = 1.252 \pm 0.010$ Å, $r(N_{(2)}-N_{(3)}) = 1.133 \pm 0.010$ Å, $<ClN_{(1)}N_{(2)} = 108°40' \pm 30'$, $<N_{(1)}N_{(2)}N_{(3)} = 171°56' \pm 30'$, with Cl and $N_{(3)}$ trans. Values for the chlorine quadrupole coupling constants were obtained for all isotopic species, and for the most abundant, $^{35}Cl^{14}N_3$, were transformed into the principal field gradient axis system. The values obtained are consistent with the deduced structure. (auth)

81 INFLUENCE OF THE DISTORTED WAVE APPROXIMATION IN CALCULATIONS OF CHEMICAL REACTION CROSS SECTIONS; $Ar^+ + HD$. Gelb, Alan; Suplinskas, Raymond J. (Yale Univ., New Haven). J. Chem. Phys.; 53: 2249-57(15 Sep 1970).

Two different approximations to the formal quantum theory of rearrangement collisions were applied to the same reactive system. The comparison enables some conclusions to be drawn concerning the effects of approximations to perturbed translational motion on predicted product energy distributions. In both schemes, the exact wavefunction was approximated by a product of a translational and molecular wavefunction, where the molecular wavefunction is treated in the perturbed-stationary-state approximation. In one scheme (DWBA PSS) the translational wavefunction is expressed as a WKB solution to the appropriate elastic scattering problem, while in the other (BA PSS), free translational motion is assumed. Calculations were performed for the system $Ar^+ + HD$ using an assumed potential surface. Significant differences are noted in predicted distributions of translational exoergicity and product vibrational and rotational energy. In particular, the behavior of the most probable translational exoergicity with respect to incident energy predicted by the DWBA PSS was in substantial agreement with experiment, whereas the BA PSS consistently overestimated product excitation. Isotope effects predicted by both schemes were in serious disagreement with experiment; it was concluded that the source of this discrepancy lies largely in the neglect of the noncentral nature of the forces in this system. (auth)

82 MICROWAVE SPECTRUM, MOLECULAR STRUCTURE, AND BROMINE NUCLEAR QUADRUPOLE COUPLING TENSOR OF BROMODIBORANE. Ferguson, Arthur C.; Cornwell, C. D. (Univ. of Wisconsin, Madison). J. Chem. Phys.; 53: 1851-9 (1 Sep 1970).

The rotational spectra of eight isotopic species of bromodiborane ($^{11}B_2H_5{}^{79}Br$, $^{11}B_2H_5{}^{81}Br$, $^{10}B_2H_5{}^{79}Br$, $^{10}B_2H_5{}^{81}Br$, $^{10}B^{11}BH_5{}^{81}Br$, $^{11}B^{10}BH_5{}^{81}Br$, $^{11}B_2D_5{}^{79}Br$, and $^{11}B_2D_5{}^{81}Br$) were studied in the region 10 to 27 GHz and analyzed to obtain values for the rotational constants and the complete bromine nuclear quadrupole coupling tensor. Structural parameters found by isotopic substitution are B–B = 1.773 ± 0.003 Å, B–Br = 1.930 ± 0.005 Å, ∠B–B–Br = 121.4 ± 0.3°. The aplanarity, with estimated correction for inertial defect, yields the bridge proton–proton distance, $H_b-H_b = 1.99_2 \pm 0.002_6$ Å. Comparison of the structural parameters with those for diborane indicates that the bridge dimensions are affected negligibly by substitution of Br for terminal H. The nonvanishing bromine nuclear quadrupole coupling tensor elements for ^{79}Br in $^{10}B_2H_5Br$ are, in megahertz, $\chi_{aa} = 288.8_7 \pm 0.1_5$, $\chi_{bb} = -150.9_6 \pm 0.3_0$, $\chi_{cc} = -137.9 \pm 0.3_6$, $\chi_{ab} = -198 \pm 9$. The major principal axis of this tensor makes an angle 1.1 ± 1.0° with the B–Br internuclear line. The significant asymmetry of the tensor about the B–Br bond axis ($\eta = -0.24 \pm 0.02$) corresponds to an electron defect of 0.08 electron in the bromine p_π orbital normal to the molecular symmetry plane. The electric dipole component μ_a, determined from Stark splittings for $^{11}B_2H_5Br$, is 1.16 ± 0.03 D. (auth)

83 STUDY OF THE LOSS OF ELECTRON EXCITATION ENERGY BY RARE-EARTH IONS TO SOLVENT VIBRATIONS LOCALIZED IN DIFFERENT COORDINATION SPHERES. Kazanskaya, N. A.; Sveshnikova, E. B. Opt. Spectrosc. (USSR) (Engl. Transl.); 28: 376-9(Apr 1970).

Translated from Opt. Spektrosk.; 28: 699-704(Apr 1970).

The luminescence time τ values of the nitrates of Sm, Eu, Tb, and Dy were measured in methanol-h_4, -d_1, -d_3, -d_4, ethanol-h_6, -d_1, -d_5, -d_6, isopropanol-h_8, -d_8, water, and D_2O. The agreement between the τ values of the rare-earth (r.e.) ions studied in methanol-h_4, ethanol-h_6, and isopropanol-h_8 attests to the similar solvation of the r.e. ions by these alcohols. It is shown that when the percentage of deuteration is allowed for, the τ values for r.e. ions in different deutero-alcohols also coincide. The τ values for r.e. ions in methanol-d_4, -d_3, -d_1, and D_2O with a 100 mol.% content of the isotope in the deuterated groups are presented. The interaction strengths of the electronic excitation of the ions with the nearest OH and OD groups and with the CH and CD vibrations in the second sphere are estimated in the adiabatic approximation. (auth)

84 NEUTRON-DIFFRACTION STUDY OF $D_3Co(CN)_6$. Guedel, H. U. (Univ., Bern); Ludi, A.; Fischer, P.; Haelg, W. J. Chem. Phys.; 53: 1917-23(1 Sep 1970).

The crystal structure of $D_3Co(CH)_6$ has been determined by a neutron-diffraction analysis of a polycrystalline sample at room temperature. The deuterated compound was prepared from $H_3Co(CN)_6$. It crystallizes according to space group D_{3d}^1-$P\bar{3}1m$ with a = 6.431(4) Å and c = 5.695(4) Å. The lattice constants do not show any isotope effect within the limits of error. Slightly trigonally distorted $Co(CN)_6$ octahedra are three-dimensionally linked by N–D–N bonds. The Co–C, C–N, and N–N distances are 1.88, 1.15, and 2.60 Å, respectively. The latter distance is the shortest so far found in an N–D–N or N–H–N bond. These hydrogen bonds are either linearly symmetric or statistically asymmetric (double minimum) centered on (½, 0, ½). (auth)

85 SKELETAL MOLECULAR STRUCTURE OF CLOSO-2,3-DICARBAHEXABORANE(6) FROM MICROWAVE SPECTRAL STUDIES. Beaudet, Robert A. (Univ. of Southern California, Los Angeles); Poynter, Robert L. J. Chem. Phys.; 53: 1899-1905(1 Sep 1970).

The microwave spectra of 13 isotopic species of closo-2,3-dicarbahexaborane(6) were studied. From these results, the cage structure of this molecule was determined. The accuracy of the molecular structure was evaluated. The bond lengths determined were:

Bond	Length
B(1)–B(6)	2.434 ± 0.005 Å
C(2)–B(4)	2.297 ± 0.005 Å
B(1)–B(4)	1.721 ± 0.015 Å
B(4)–B(5)	1.752 ± 0.005 Å
B(4)–C(3)	1.605 ± 0.005 Å
C(2)–C(3)	1.540 ± 0.005 Å
B(1)–C(2)	1.627 ± 0.015 Å

The measured dipole moment was 1.50 ± 0.03 D. (auth)

86 INFRARED SPECTRA OF MATRIX-ISOLATED ACETIC ACID MONOMERS. Berney, C. V. (Univ. of New Hampshire, Durham); Redington, R. L.; Lin, K. C. J. Chem. Phys.; 53: 1713-21(1 Sep 1970).

Infrared spectra of monomeric acetic acids [$CH_3COOH(D)$ and $CD_3COOH(D)$] isolated in Ar and N_2 matrices near 4°K are reported. A large anharmonic potential-energy contribution is evident from the observed isotopic frequency shifts. It is proposed that this arises primarily from the double-minimum potential-energy curve for tunneling of the H atom between O atoms via the COH angle bending coordinate. In all cases, important coupling between the COH angle bending and C–O stretching coordinates was observed, with a strong addition of CD_3 (umbrella) angle deformation in the case of CD_3COOH. Exceptional matrix effects are observed for the coupled vibrations of the –OH molecules. A complete assignment is proposed for these acetic acids on the basis of the new data. As additional supporting evidence, the spectrum of matrix-isolated CH_3COF and of acetic acid vapor at low pressure and long path length are reported. (auth)

87 LIQUID TRITIOAMMONIA AS A TRITIATING AGENT. Bloss, K. (Battelle-Institut e. V., Frankfurt am Main). J. Label. Compounds; 5: 355-62(Oct-Dec 1969).

Tritioammonia, 10 Ci/g, tritiated piperdine, 5-hydroxytryptophan, glutamine, and asparagine were refluxed at –35°C. Within 1.5 to 6 hr the specific activities reached 0.02, 0.775, 1.24, and 2.48 mCi/mmole. Cyclooctatetraene was not exchange-labeled under these conditions. For liquid-scintillation counting of tritioammonia, ortho-bromobenzoic acid in toluene–dioxane served well. Autoradiolysis was no problem. (auth)

88 FIRST-ORDER BASE-INITIATED β-ELIMINATION REACTION INVOLVING A CARBANION INTERMEDIATE. Bordwell, F. G.; Yee, K. C.; Knipe, A. C. (Northwestern Univ., Evanston, Ill.). J. Amer. Chem. Soc.; 92: 5945-9(7 Oct 1970).

A kinetic analysis of the methoxide-ion-initiated elimination of MeOH from 2-phenyl-trans-2-methoxy-1-nitrocyclopentane (1) or its cis isomer (2) has shown that it proceeds by a rapid second-order reaction to form a nitronate ion (3) followed by a slow, rate-limiting first-order loss of methoxide ion from 3 to give 2-phenyl-1-nitrocyclopentene (4). The latter step is reversible, and the equilibrium favors 3 over 4 by a factor of 530/1 at 1 M[MeO^-]. Under the conditions of the reaction, 4 is formed in only a steady-state concentration because it undergoes a further rapid reaction with methoxide ion to give nitronate ion 5. The overall reaction 1 (or 2) to 4 is an example of a first-order β elimination involving a carbanion (nitronate ion) intermediate. Examination of deuterium isotope effects for 1 and for 4 allowed evaluation of the rate constants for both the forward and reverse steps in the reaction

sequence 1 ⇌ 3 ⇌ 4 → 5. The proposed kinetic scheme was subjected to an analog computer analysis, which showed the formation of steady-state concentrations of 4 and provided a pictorial representation of the rate phenomena starting from 3 and from 4. (auth)

89 CARBONIUM IONS. XVI. THE QUESTION OF PROTONATED CYCLOPROPANES IN THE REACTIONS OF ZINC CHLORIDE WITH 1-PROPANOL AND 1-CHLOROPROPANE. Karabatsos, Gerasimos J.; Zioudrou, Christine; Meyerson, Seymour (Michigan State Univ., East Lansing. American Oil Co., Whiting, Ind.). J. Amer. Chem. Soc.; 92: 5996-8(7 Oct 1970).

The reaction of 1-propanol-1,1-d_2 with zinc chloride and hydrochloric acid gave a 70% yield of chloropropane consisting of 89% 1-chloropropane and 11% 2-chloropropane. The mixture obtained from the corresponding reaction of 1-propanol-2,2-d_2 consisted of 95% 1-chloropropane and 5% 2-chloropropane. This difference in the chloropropane ratio was ascribed to k_H/k_D isotope effect of the intramolecular 1,2-hydride shift. The 1-chloropropane obtained from the reaction of 1-propanol-1,1-d_2 consisted of 98.3% $C_2H_5-CD_2Cl$, 0.2% $C_2H_4D-CHDCl$, and 1.5% $C_2H_3D_2-CH_2Cl$. That from the reaction of 1-propanol-2,2-d_2 consisted entirely of $C_2H_3D_2-CH_2Cl$ molecules. These results were interpreted in terms of the intervention (about 2%) of a protonated cyclopropane path, where the rate of the intramolecular rearrangements of the protonated cyclopropane is slower than the rate of reaction of the protonated cyclopropane with nucleophile. In this sense, the isotope-position rearrangement resembles a nominal 1,3-hydride shift. Protonated cyclopropane intermediates were detected neither in the reactions of labeled 1-propanols with thionyl chloride in pyridine, nor in the reactions of labeled 1-chloropropanes with silver nitrate or zinc chloride and hydrochloric acid. None of these reactions gave any detectable 2-propyl product. (auth)

90 CARBANION MECHANISM (E1cB) OF ESTER HYDROLYSIS. III. SOME STRUCTURE–REACTIVITY STUDIES AND THE KETENE INTERMEDIATE. Pratt, R. F.; Bruice, Thomas C. (Univ. of California, Santa Barbara). J. Amer. Chem. Soc.; 92: 5956-64(7 Oct 1970).

The hydrolyses of carboxylic acid esters were studied kinetically in order to further establish the ElcB mechanism as an acyl transfer path for esters. The principal feature of this mechanism is elimination of the leaving group from the carbanion formed from the ester by ionization at a position α to the ester group. Such carbanion species were observed spectrophotometrically with all of the above esters and appeared during hydrolysis under conditions ranging from steady state through fast preequilibrium. The nature of the leaving group emerged as an extremely important factor in determining the relative contributions of the ElcB and BAc2 mechanisms. Yields of acetoacetanilide obtained from hydrolysis of p-nitrophenyl acetoacetate in the presence of aniline buffers were examined in detail and compared with the kinetics of p-nitrophenol release. These results as well as those establishing a change of rate-limiting step with increase in general base concentration and the deuterium solvent isotope effect are fully in accord with an ElcB hydrolysis mechanism, which proceeds by way of a transient free ketene after elimination of the leaving group from the carbanion. (auth)

91 MOLECULAR g-VALUE, MAGNETIC SUSCEPTIBILITY ANISOTROPY, AND MOLECULAR QUADRUPOLE MOMENT IN OCSe. Shoemaker, R. L.; Flygare, W. H. (Univ. of Illinois, Urbana). Chem. Phys. Lett.; 6: 576-8(15 Sep 1970).

The molecular Zeeman effect has been observed in $^{16}O^{12}C^{80}Se$ and $^{16}O^{12}C^{78}Se$. The molecular g-value are $g_\perp = -0.01952 \pm 0.0001$ and $g_\perp = -0.01969 \pm 0.0001$ respectively. The magnetic susceptibility anisotropy, which is independent of the center of mass, is $\chi_\perp - \chi_\parallel = (10.06 \pm 0.18) \times 10^{-6}$ erg/G^2 mole. The molecular quadrupole moment in $^{16}O^{12}C^{80}Se$ is $Q_\parallel = -(0.32 \pm 0.24) \times 10^{-26}$ esu cm^2. An upper limit is given for the nuclear magnetic shielding anisotropy at the ^{77}Se nucleus in OC ^{77}Se. (auth)

92 $\tilde{X}^1A_1 - \tilde{a}$ AND $\tilde{X}^1A_1 - \tilde{A}^1B_1$ ELECTRONIC TRANSITIONS OF PYRIDAZINE-d_0, -d_2, AND -d_4 VAPORS. Innes, K. K. (State Univ. of New York, Binghamton); Tincher, W. C.; Pearson, Earl F. J. Mol. Spectrosc.; 36: 114-40 (Oct 1970).

High resolution absorption spectra of 1,2-diazine and two deuterated modifications were measured between 3000 and 5000 Å, and analyzed. Two excited electronic states, a singlet and a triplet, were identified. Rotational analyses of the 0–0 bands of the two systems showed the systems to be $^1B_1 - {}^1A_1$ (3700 Å) and $^3A_2 - {}^1A_1$ or $^3B_1 - {}^1A_1$ (4450 Å). The sharp rotational structure of the $^1B_1 - {}^1A_1$ 0–0 band of pyridazine-d_0 indicated a condition on the change of inertial constants not identified before for planar asymmetric rotors, namely, $C' - C'' = \overline{B}' - \overline{B}''$ (where $\overline{B} = (A + B)/2$). Changes in A, B, and C found by contour analysis prove that the molecule is elongated by an (atomic) average of about 10% along a direction perpendicular to the symmetry axis. Isotope effects are used to demonstrate that the extreme complexity of vibrational structure on the high-frequency side of the origin arises from large and extensive Fermi (anharmonic) resonances, linking ν'_{6a} and the overtone of an antisymmetric mode thought to be μ_{16b}. (auth)

93 MANDELIC ACID RACEMASE FROM PSEUDOMONAS PUTIDA. EVIDENCE FAVORING A CARBANION INTERMEDIATE IN THE MECHANISM OF ACTION. Kenyon, George L.; Hegeman, George D. (Univ. of California, Berkeley). Biochemistry; 9: 4036-43(13 Oct 1970).

Substantial deuterium exchange occurs in the α-carbon position of mandelic acid during the racemization of unlabeled D-(–)-mandelic acid by mandelic acid racemase (EC 5.1.2.2) in 96% D_2O, or when the racemization of D-(–)-α-deuteriomandelic acid is catalyzed by the enzyme in H_2O. Under similar conditions no significant amount of ^{18}O was found to be incorporated into the mandelic acid when D-(–)-mandelic acid was enzymatically racemized in ^{18}O-enriched water. Benzoylformic acid was excluded as a reaction intermediate since, in the presence of the enzyme, [^{14}C]benzoylformic acid did not give rise to [^{14}C]mandelic acid and [^{14}C]mandelic acid did not yield [^{14}C]benzoylformic acid. The enzyme catalyzed with approximately equal efficiency the incorporation of radioactivity into the D-(–) and L-(+) enantiomers during partial racmization of the D-(–)-mandelic acid in tritiated water. The V_{max} for the enzyme-catalyzed conversion of D-(–)-α-deuteriomandelic acid to the L-(+) enantiomer was approximately five times less than that observed for the normal protonated substrate. A mechanism involving a carbanion intermediate is consistent with these and other findings. (auth)

94 LIGAND ISOTOPE EFFECT IN URANYL EMISSION. Pant, D. D.; Tripathi, H. B. (DSB Government Coll., Naini Tal, India). Indian J. Pure Appl. Phys.; 7: 140(Feb 1969).

The effect of deuteration of the acetate group in sodium uranyl acetate was studied. On deuteration the (0,0) band shifted by a small amount and the U–OI frequency also decreased. A large isotopic shift (~93 cm^{-1}) was found in only one ligand band. The fluorescence lifetime was not affected on deuteration. (auth)

95 KINETIC HYDROGEN ISOTOPE EFFECTS IN THE IONIZATION OF SOME CARBON ACIDS. Barnes, D. J.; Bell, R. P. (Oxford Univ.). Proc. Roy. Soc. (London), Ser. A; 318: 421–40(22 Sep 1970).

Rate constants in aqueous solutions are reported for proton and deuteron abstraction by a variety of bases from tricarbomethoxymethane, the propan-2-one-1-sulphonate ion, 2-acetylcyclohexanone and ethyl nitroacetate. The rates of ionization were measured by using bromine or iodine as scavengers to remove the anions, and, for ethyl nitroacetate by direct observation of the rate of appearance of the anion. The kinetic isotope effects vary from $k^H/k^D = 2.5$ to $k^H/k^D = 10.3$, and confirm the regularities previously found (Bell & Crooks 1965; Bell & Goodall 1966). In particular, the results for the reaction of ethyl nitroacetate with nine bases show clearly that with increasing basic strength the isotope effect passes through a well-marked maximum. Sterically hindered pyridine bases give rise to abnormally high isotope effects, probably attributable to increased tunnel corrections. (auth) (UK)

96 EQUILIBRIUM NITROGEN ISOTOPE EFFECTS IN METAL AMMINE/AMMONIA SYSTEMS. Jeevanadam, M.; Gupta, A. R. (Bhabha Atomic Research Centre, Bombay). Indian J. Chem.; 8: 436-41(May 1970).

A simplified M–NH_3 model with Modified Urey–Bradley Force Field (MUBFF) has been used to calculate the vibrational frequencies of many ^{14}N- as well as ^{15}N-substituted transition metal ammines and mixed complexes. The primary nitrogen isotope effects in 22 complex/ammonia systems were calculated from the vibrational frequencies. A linear relationship between the mean value of the stability constant of the complex in aqueous solution and the isotope effect was observed. This relation is discussed in terms of the theory of isotope effects in chemical equilibria. The change of the nitrogen isotope effect on the successive replacements of ammonia molecules by a more electronegative ion like Cl^- is consistent with the general conclusions drawn from the chemical studies of such complexes. An influence of the molecular geometry on the nitrogen isotope effect of the cis- and trans-Pt(II) and Pd(II) diammines is demonstrated. (auth)

97 ANGSTROEM SYSTEM OF THE $^{12}C^{14}O$ MOLECULE. Rytel, M. (Teacher Training Coll., Rzeszow, Poland). Acta Phys. Pol.; A38: 299-308(Sep 1970).

Photographs were made of the Angström system in the emission

spectrum of the $^{12}C^{18}O$ molecule with dispersion between 0.6 and 1.1 Å/mm. Rotational analysis was undertaken and points of perturbation found. For the $B^1\Sigma^+$ state the following constants were obtained: $G(1) - G(0) = (2033.56_4 \pm 0.02_4)$ cm^{-1}, $B_0 = (1.8553_3 \pm 0.0001_2)$ cm^{-1}, $D_0 = (6.1_1 \pm 0.1_2) \times 10^{-6}$ cm^{-1}, and $B_0 - B_1 = (0.0244_8 \pm 0.0002_8)$ cm^{-1}. In addition, for the $A^1\pi$ state, some rotational constants and oscillation quanta from the less perturbed bands were calculated. The results obtained for three isotope molecules of carbon oxide were used to obtain the vibrational and rotational constants for both electronic states. The perturbation shifts of the origins of the bands of all three molecules and isotopic electronic shifts were also found. (auth)

98 VIBRATIONAL EXCITON DENSITY OF STATES IN SOLID BENZENE. Laufer, J. C.; Kopelman, R. (Univ. of Michigan, Ann Arbor). J. Chem. Phys.; 53: 3674-81(1 Nov 1970).

Computer-aided calculations, based on experimentally fitted pairwise interaction terms, give the complete exciton density-of-states profile for the entire Brillouin zone. The restricted Frenkel model, with short-range interactions, is the key assumption. Results are given and discussed for the out-of-plane a_{2u} normal mode $\nu_{11}(C_6H_6$ and $C_6D_6)$, for $\nu_{12}(b_{1u})$, and for $\nu_{15}(b_{2u})$. The wide range of parameters used makes this investigation pertinent to other vibrational and electronic exciton bands of benzene and any other molecular crystal with the same interchange symmetry. Also, Van Hove singularities are found to be more important for symmetry-based critical points than for "accidental" critical points. Present-day experimental and theoretical intermolecular excitation exchange interaction terms are compared. (auth)

99 FAR-INFRARED SPECTRA OF CONDENSED METHANE AND METHANE-d_4. Savoie, R.; Fournier, R. P. (Univ. Laval, Quebec). Chem. Phys. Lett.; 7: 1-3(1 Oct 1970).

The far-ir spectra of thick samples of liquid and solid CH_4 and CD_4 have been recorded in the 20 to 200 cm^{-1} region. Only one broad band was seen in the spectra of the liquids and solids in their phase I. The presence of two translational lattice modes in the spectra of phase II was consistent with the cubic structure with space group T^4-$P2_13$ and site symmetry C_3. The spectrum of CD_4 suggested a slight departure from cubic symmetry in phase III. (auth)

100 VISCOSITY OF HYDROGEN DEUTERIDE AT CONSTANT DENSITY IN TEMPERATURE RANGE FROM 20.4 TO 300°K. Slyusar, V. P.; Rudenko, N. S. (Inst. of Physics and Tech., Kharkov). Ukr. Fiz. Zh.; 14: 1913-15(Nov 1969). (In Russian).

The viscosity of HD was measured using hydrogen deuteride prepared in a rectification column with a mixture of H_2, HD, and D_2 formed during electrolysis of a 50% solution of light and heavy water. Tabulated data are given on the dynamic and kinematic viscosity as a function of the density at constant temperatures. (R.V.J.)

101 PRIMARY ISOTOPE EFFECTS FOR AROMATIC NITROSATION. Challis, B. C.; Higgins, R. J.; Lawson, A. J. (St. Salvators Coll., Fife, Scotland. Imperial Coll. of Science and Tech., London). J. Chem. Soc., D; No. 18, 1223-4(Sep 1970).

Substantial deuterium isotope effects for nitrosation of a range of aromatic and heteroaromatic species show that decomposition of a Wheland-type intermediate is usually rate-limiting in aqueous acids, except for very reactive compounds when the reaction rates are encounter-controlled. (auth) (UK)

1C2 HYPERFINE STRUCTURE AND DIPOLE MOMENT OF CH_3D. Woïsy, S. C.; Muenter, J. S.; Klemperer, W. (Harvard Univ., Cambridge, Mass.). J. Chem. Phys.; 53: 4005-14(15 Nov 1970).

The electric resonance spectrum of deuteromethane (CH_3D) was measured in the two rotational states, J = 1, K = 1 and J = 2, K = 2. From these data the dipole moment and hyperfine constants of the molecule were obtained. The results for the methane-related spin rotation constants are $c_\alpha = 16.54 \pm 0.35$, and $c_\beta = -1.58 \pm 1.0$ kHz. The quadrupole coupling constant eqQ at the deuterium nucleus is found to be eqQ = 191.48 ± 0.77 kHz. The electric dipole moments $\mu(J,K)$ are $\mu(1,1) = 5.6409 \times 10^{-3}$ and $\mu(2,2) = 5.6794 \times 10^{-3}$ D. (auth)

103 VAPOR PRESSURES OF ^{36}Ar AND ^{40}Ar. INTERMOLECULAR FORCES IN SOLID AND LIQUID ARGON. Lee, Myung W.; Fuks, Salomon; Bigeleisen, Jacob (Univ. of Rochester, N. Y.). J. Chem. Phys.; 53: 4066-76(15 Nov 1970).

The vapor pressures of ^{36}Ar and ^{40}Ar were measured in the temperature range 62 to 102°K. Measurements in the liquid agree quantitatively with the previous measurements of Clusius et al., which cover the limited range 84 to 88°K. A significant difference was found between the equilibrium measurements, which have a precision of 0.5% in the logarithm of the vapor pressure ratio, and dynamic measurements of the isotope fractionation in solid-vapor systems. The reduced partition functions of the solid and liquid were calculated from the observed vapor pressure ratios. The reduced partition ratio of the solid can be represented by the equation $T^2 \ln (fs/fg) = 63.39 \pm 0.34 - (0.124 \pm 0.005)\ T - (95/63)\ (63.4 - 0.124T)^2/T^2$. The experimental values ln (fs/fg) are in good agreement with calculations from the improved self-consistent phonon theory of an anharmonic lattice with a 13-6 potential. Since the quantum effect is small, $\langle\nabla^2 U\rangle$ is obtained directly from the reduced partition functions. In the liquid range the experimental results agree quantitatively with previous estimates based on 12-6 potential, with calculations from molecular dynamics and with the Rowlinson correlation function. It is shown that the reduced $\langle\nabla^2 U^*\rangle$ is the same for neon and argon both in the liquid and solid. The change in $\langle\nabla^2 U\rangle$ on melting is discussed in terms of the change of the number of nearest neighbors on melting and the "significant structure theory of liquids." (auth)

104 STRUCTURE OF THE ALUMINATE ION IN SOLUTIONS AT HIGH pH. Moolenaar, R. J.; Evans, J. C.; McKeever, L. D. (Dow Chemical Co., Midland, Mich.). J. Phys. Chem.; 74: 3629-36(1 Oct 1970).

Infrared and Raman spectra of sodium aluminate dissolved in H_2O and D_2O and ^{23}Na and ^{27}Al NMR spectra of sodium aluminate dissolved in H_2O were obtained in the concentration range 0.5 to 6M. At Al concentrations below 1.5M, four vibrational bands were observed in H_2O, two of them infrared active at ~950 and 725 cm^{-1}, and three Raman active at 725, 625, and 325 cm^{-1}. The ^{27}Al NMR showed a narrow resonance line. These data are consistent with the existence of the tetrahedral $Al(OH)_4^-$ as the predominant aluminum-bearing species in solution. At aluminum concentrations of about 1.5 M and above, a new vibrational band appeared at 900 (ir), 705, and 540 cm^{-1} (R). The ^{27}Al NMR resonance was considerably broadened, but no change in chemical shift was noted. These observations are interpreted in terms of the condensation of $Al(OH)_4^-$ with increasing concentration to form $Al_2O(OH)_6^{2-}$, such that in 6M solution the two forms coexist. (auth)

105 INTERMEDIATES IN ETHYLENE HYDROGENATION OVER ZINC OXIDE. Dent, A. L.; Kokes, R. J. (Johns Hopkins Univ., Baltimore). J. Phys. Chem.; 74: 3653-62(1 Oct 1970).

Isosteric heats of adsorption for ethane and ethylene were determined from isotherms at 0 and 20°C. The heats for initial adsorption (5 kcal for ethane and 14 kcal for ethylene) suggest ethane is physically adsorbed, whereas ethylene is (in part) chemically adsorbed. The infrared spectrum of the chemically adsorbed ethylene yields bands corresponding roughly to fundamentals for gaseous ethylene and includes several bands forbidden in the ir of the latter species. One of such bands is the C=C stretch. Details of the spectrum suggest adsorbed ethylene is olefinic in character and bound to the surface by interaction of the π electrons. Studies of the spectrum in a flow system show that in the presence of a hydrogen-ethylene stream during hydrogenation, a new adsorbed species is formed; this aliphatic hydrocarbon species, X, is rapidly removed by hydrogen alone. The initial rate of removal of X by hydrogen is comparable to the steady state hydrogenation rate; hence, X behaves as an intermediate. Similar experiments with $D_2-C_2H_4$ and $H_2-C_2D_4$ as reacting streams were also carried out. It was concluded that the resulting data are consistent with an assignment of the spectrum of X to an alkyl intermediate attached to the zinc half of the zinc-oxygen active site. (auth)

106 PHASE TRANSITIONS IN AMMONIUM AND DEUTERO-AMMONIUM HALIDES. Hovi, V. (Univ. of Turku, Finland). Radiat. Eff.; 4: 67-76(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Recent results obtained by dilatometric, calorimetric, x-ray, and NMR methods for the phase transitions in ammonium and deutero-ammonium halides are reported. The dilatometric observations on the kinetics of the transitions I-II of NH_4Cl and NH_4Br, and the effects of deuteration on the I-II transformation temperature and volume change, and on the thermal expansion coefficients of the modifications I and II of NH_4Br are described. Lattice parameter data, obtained by x-ray diffraction for NH_4Cl between 167 and 250°, for NH_4Br and ND_4Br between -192° and 196°C, and for NH_4I between -116° and +22°C are presented. From these data, the molar volume changes for the I-II transition of NH_4Cl, for the I-II, II-III, and III-IV transitions of NH_4Br and ND_4Br, and for the I-II and II-III transitions of NH_4I are reported. The effect of deuteration on the thermal expansion of modifications I, II, and III of NH_4Br, and the structural nature of the III-IV transition of NH_4Br are examined. The energies of the transitions I-II of NH_4Cl, NH_4Br, and NH_4I, and of the λ-transition of NH_4Cl, determined by a direct differential calorimetric method with an

accuracy of about 3 percent, are presented. The activation energies of the reorientational motions of ND_4^+ and NH_4^+ ions in polycrystalline NH_4Cl, ND_4Cl, NH_4Br, and ND_4Br, and NH_4I and ND_4I, obtained by measuring nuclear magnetic spin–lattice relaxation times of deuteron and proton as functions of temperature, are discussed. (auth)

107 REACTION BETWEEN DEUTERIUM AND CYCLIC OLEFINS ON PLATINUM/ALUMINA IN THE LIID PHASE. Philipson, J. J.; Burwell, Robert L. Jr. (Northwestern Univ., Evanston, Ill.). J. Amer. Chem. Soc.; 92: 6125-33(21 Oct 1970).

Reactions in the liquid phase between deuterium and cyclopentene, cyclohexene, cycloheptene, cyclooctene, bicyclo[3.3.0]-2-octene, and 1-hexene on platinum/alumina are reported. Runs involved the solvents: none, tetrahydrofuran (THF), THF + D_2O, CH_3COOD, CH_3OD, $(CH_3)_3COD$, and ethanolamine-d_3 + CH_3OD. The exchange reaction, $H^* + ROD = D^* + ROH$, proceeds rather rapidly, thus considerably increasing (D^*/H^*) over the low value obtained during runs with no solvent or with THF. The increased (D^*/H^*) facilitates interpretation of the isotopic distributions of the cycloalkanes that are formed. These distributions can now be seen closely to resemble those found in exchange of each cycloalkane with deuterium on platinum, a result that strongly supports the view that exchange of alkanes and hydrogenation of alkenes are closely interlinked mechanistically. The isotopic distributions of cycloalkanes formed in exchanging solvents indicate that there are at least two sets of surface sites. One is characterized by large (D^*/H^*), some simple addition hydrogenation, all or most of the exchange-addition hydrogenation leading to ane-d_3, ane-d_4, ..., and a substantial rate of $H^* + ROD = D^* + ROH$. The second set involves only or mainly simple addition hydrogenation, formation of exchanged olefin, and a relatively small rate of $H^* + ROD = D^* + ROH$. There are differences among the solvents; CH_3COOD gives much the most exchange-addition hydrogenation, ethanolamine gives much the most simple addition hydrogenation. (auth)

108 KETONIZATION OF GASEOUS ENOL IONS. McAdoo, D. J.; McLafferty, F. W.; Smith, J. S. (Cornell Univ., Ithaca, N. Y.). J. Amer. Chem. Soc.; 92: 6343-5(21 Oct 1970).

It is shown that the major decomposition pathways of three simple enol ions appear to involve initial ketonization. A substantial primary isotope effect was observed. (M.C.G.)

109 O_2^+–HD REACTIONS AT HIGH ENERGY: A NEW TYPE OF ISOTOPE EFFECT. Chiang, M. H.; Mahan, B. H.; Tsao, C. W.; Werner, A. S. (Univ. of California, Berkeley). J. Chem. Phys.; 53: 3752-3(1 Nov 1970).

It was demonstrated that an isotope effect occurs in the O_2^+ – HD reaction at high (>6 eV) relative collision energies. Reaction occurs through formation of a long-lived HDO_2^+ complex, which decays to give isotropic distributions of both HO_2^+ and DO_2^+. The angular distributions of HO_2^+ and DO_2^+ were of totally different form, with the HO_2^+ almost exclusively in the small-angle, grazing collision region, and the DO_2^+ predominantly in the large-angle, rebound collision region. The OH^+ product fell principally at angles smaller than 90°, and OD^+ predominates at angles greater than 90°. (M.C.G.)

110 BASICITIES AND H–D EXCHANGE OF PYRAZINE N-OXIDES. Paudler, William W.; Humphrey, Sharon A. (Ohio Univ., Athens). J. Org. Chem.; 35: 3467-70(Oct 1970).

The hydrogen–deuterium exchange rates of H_2 and H_6 in some 3-substituted pyrazine 1-oxides were correlated with σ constants, and the log of the H_2 exchange rates were shown to be linearly related to the pK_a's of these compounds. The implication of these results upon the intermediacy of an ylide-like intermediate are discussed. (auth)

111 CLEAVAGE OF PYRIDYL METHYL ETHERS AND REACTIONS OF 3-HALOPYRIDINES WITH SODIUM METHOXIDE. Zoltewicz, John A.; Sale, A. A. (Univ. of Florida, Gainesville). J. Org. Chem.; 35: 3462-7(Oct 1970).

Methoxypyridines and anisole were readily cleaved to their hydroxy arenes and methyl ether in an S_N2 reaction by sodium methoxide in methanol. Using CD_3OD-D_2O as solvent and NMR analysis, it was possible to distinguish between CH_3OCD_3 and CH_3OD reaction products and thereby show that deuterioxide ion does not compete with methoxide ion in the cleavage of 3-methoxypyridine. With 4-methoxypyridine, methoxyl group exchange was faster than the formation of 4-hydroxypyridine. 3-Methoxypyridine undergoes hydrogen-deuterium exchange in the order H-4 > H-5 > H-2; no exchange at H-6 was observed. Hydrogen-deuterium exchange took place at H-3,5 but not at H-2,6 of 4-methoxypyridine. At 218°C, 3-chloro- and 3-bromopyridine react with sodium methoxide to give 3-methoxypyridine which then undergoes ether cleavage. The concentrations of all pyridines in the consecutive reactions were followed by NMR. The ratios of the second-order rate constants for methoxy dehalogenation and ether cleavage at 218°C are 0.53 and 0.75, respectively. Reactions leading to hydroxy compounds are of preparative value. No evidence was found for the formation of 3,4-pyridine by dehydro halogenation of the halopyridines. (auth)

Physical Chemistry

Refer also to abstracts 127, 228, 770, 792, 1104, and 1323.

112 (ANL-Trans-859) ASTATINE, THE FIFTH HALOGEN. Samson, G. Translated for Argonne National Lab., Ill., from Chem. Weekbl.; 27-31(7 Nov 1969). 11p. Dep. NTIS.

Methods for the preparation of astatine, astatoacetic acid, and n-alkylastatides are given. Properties of astatoacetic acid and n-alkylastatides were studied. The boiling points of C_2H_5At, C_3H_7At, C_4H_9At, $C_5H_{11}At$, and $C_6H_{13}At$ were determined. Various methods for the synthesis of astatobenzene are discussed. (J.G.B.)

113 (AWRE-O-37/70) SURFACE FILMS ON PLUTONIUM SOLUTIONS. PART 1. Robertson, R. B. (Atomic Weapons Research Establishment, Aldermaston (England)). Jul 1970. 37p. Dep. NTIS (U. S. Sales Only). UK 7s.

Under certain conditions solutions of tetravalent plutonium salts exhibited α activities at the surface that were abnormally high and increased considerably on standing. The cause of this was shown to be absorption of colloidal plutonium hydroxide at the water–air interface to produce a film that could be removed by the passage of a glass slide over the solution surface. Alpha spectrometry showed that the film was too thin to give appreciable self-absorption. Specimens of the film were removed from the liquid surface and their structure examined in the electron microscope; shadowing with palladium indicated a maximum thickness of about 150 Å. The behavior of the film on compression was investigated with a modified Langmuir film balance; its α activity was found to be inversely proportional to its area and force-area curves were obtained, similar to those given by organic monofilms. The kinetics of film formation were investigated and a mechanism is suggested. (auth)

114 (CEA-R-3717) THERMAL DECOMPOSITION OF URANYL NITRATE HEXAHYDRATE. STUDY OF INTERMEDIATE REACTION PRODUCTS. Chottard, Genevieve (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Jun 1970. 54p. (In French). Dep. CFSTI (U. S. Sales Only).

Thesis. Submitted to Univ., Paris.

The thermal decomposition of uranyl nitrate hexahydrate was carried out at a constant pressure and a constant reaction rate. The following intermediate products were observed: $UO_2(NO_3)_2 \cdot 3H_2O$; $UO_2(NO_3)_2 \cdot 2H_2O$; $UO_2(NO_3)_2 \cdot H_2O$; $UO_2(NO_3)_2$; and UO_3. These products as well as the hexahydrate $UO_2(NO_3)_2 \cdot 6H_2O$, were studied by x-ray diffraction, using the Debye–Scherrer method; infrared spectrography for the determination of the type of bonding between water and nitrate groups; and nuclear magnetic resonance for the study of the mobility of water molecules. The main results concern the water molecule bonds in the series of hydrates with 6, 3, and $2H_2O$ molecules, the isolation and characterization of uranyl nitrate monohydrate and the determination of its molecular structure, the mobility of water molecules in the series of the hydrates with 6, 3, and $2H_2O$ molecules. An analysis was made of the complementary results given by infrared spectroscopy and nuclear magnetic resonance; they were interpreted for the whole hydrate series. (auth) (France)

115 (CONF-700403-(Vol.1), pp 305-9) MOBILITIES OF RARE EARTH CATIONS BY BROMINE REDOX ELECTROLYSIS WITH POROUS CARBON ELECTRODES. Onstott, E. I. (Los Alamos Scientific Lab., N. Mex.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The mobility ratios of two pairs of rare earth cations were measured for chloride electrolytes and for chloride-sulfate electrolytes in which the chloride-sulfate ratio was equal to one. The mobility ratio for Pr(III)/Nd(III) was measured to be 1.00 ± 0.02 for both electrolytes. The mobility ratio of Nd(III)/Ho(III) in chloride electrolyte was measured to be 1.053 ± 0.006, and the ratio in chloride-sulfate electrolyte was 0.979 ± 0.012. Sulfate had the effect of reversing the relative mobilities of Nd(III) and Ho(III). (auth)

116 (CONF-700403-(Vol.2), pp 673-81) VIBRATIONAL SPECTRA OF THE C-TYPE RARE EARTH OXIDE STRUCTURE. White, William B. (Pennsylvania State Univ., University Park. Materials Research Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume II. Sessions I through M.

Compounds having the C-type rare earth oxide structure, space group Ia3, T_h^7, include the smaller rare earths and the oxides Mn_2O_3, Sc_2O_3, In_2O_3, and Tl_2O_3. Group theoretical analysis of the structure predicts the distribution of vibrational modes and selection rules: $4A_g$(Raman) + $4E_g$ (Raman) + $14T_g$ (Raman) + $5A_u$ (inactive) + $5E_u$ (inactive) + $16T_u$(IR). The predictions can account for all observed IR bands of the rare earth oxides although no one compound exhibits all modes. The spectra of all compounds subdivide into a high frequency set, 700 to 550 cm^{-1}, and intense, broad set near 400 cm^{-1}, and three sets of sharp lower frequency modes. The high frequency set correlates with unit cell size and with interatomic distances. In_2O_3 exhibits an anomalous splitting of the high frequency land. (auth)

117 ABSORPTION SPECTRA OF DISCHROISM OF CRYSTALLINE URANYL NITRATE. Komyak, A. I.; Sevchenko, A. N. (Belorussian State Univ., Minsk). Dokl. Akad. Nauk BSSR; 12: 1081-4(Dec 1968). (In Russian).

Absorption spectra of crystalline uranyl nitrate were studied in linear-polarized light at room temperature. The direction of light was perpendicular to the optical axis for uniaxial crystals and to the plane of optical axes for biaxial crystals. In uniaxial crystals, absorption of the unique beam is negligible and varies little along the spectra in all structural fields of absorption spectra. Ordinary beams do not exhibit strong variations in molar absorption coefficients during transition from one band series to another. Anisotropy of absorption was expressed less sharply in biaxial crystals than in uniaxial crystals. Positive and negative crystals exhibited variable dichroism. Variations in dichroism confirm the postulation on the presence of four excited electron states of the uranyl ion in the structural field of absorption spectra. (tr-auth)

118 POTENTIOMETRIC DETERMINATION OF STABILITY CONSTANTS OF BIVALENT AND RARE EARTH METAL COMPLEXES WITH 2,3-PYRIDINEDIOL. Geol, D. P.; Dutt, Y.; Singh, R. P. (Univ. of Delhi). J. Inorg. Nucl. Chem.; 32: 3119-22(Sep 1970).

Considerable work has been reported on determination of the stability constants of metal complexes with the o-dihydroxy derivatives of benzene, and it was considered of interest to determine the stability constants of the corresponding heterocyclic analogue of catechol (2,3-pyridinediol or 2,3-dihydroxypyridine). Data are reported for UO_2(II), Cu(II), Pb(II), Zn(II), Be(II), Ni(II), Co(II), Cd(II), Mn(II), La, Ce(III), Pr, Nd, Sm, Gd, Er, and Yb. (UK)

119 VOLTAMMETRY OF THE NEPTUNYL GLUTARATE COMPLEX AT THE ROTATING GLASSY CARBON ELECTRODE. Plock, C. E. (Dow Chemical Co., Golden, Colo). Contract AT(29-1)-1106. Anal. Chim. Acta; 47: 27-53(1969).

The voltammetry of the neptunyl glutarate complex was investigated over widely varying conditions of ligand concentration and pH. A reversible, one-electron wave was obtained in nearly all glutarate concentration ranges investigated over the pH range 0.0 to 6.6. The half-wave potential was independent of the pH in the ranges 0.0 to 1.0 and 4.0 to 6.6, but was a function of the pH in the range 1.0 to 4.0. The maximum metal-ligand ratio was found to be 1:3 by conductometric and amperometric titrations. The diffusion coefficient was 0.21×10^{-5} cm^2/sec at pH 3.1 and 0.15×10^{-5} cm^2/sec at pH 5.3. The stability constant of the neptunyl glutarate complex was determined as 1.6×10^{-5}. (auth)

120 EFFECT OF DILUENTS ON THE ADDUCT FORMATION OF ERBIUM THIOCYANATE WITH TRIBUTYL PHOSPHATE. Nakamura, Keikichi (National Research Inst. for Metals, Tokyo). J. Inorg. Nucl. Chem.; 32: 2265-74(Jul 1970).

The stoichiometric stability constants $K_{3,4}$ of erbium thiocyanate with TBP in a number of diluents were determined using ir spectroscopy. Using the values of the stability constants and of the activity of TBP in the same diluents, activity coefficient ratios of the complexes, $y_{TBP_3Er(SCN)_3}/y_{TBP_4Er(SCN)_3}$ were estimated. The results show that the stoichiometric stability constants are very sensitive to the slight changes in the electron donor and the acceptor abilities of the diluents. The activity coefficient is related to the acceptor ability of the diluent and the activity coefficient ratio of the complexes is related to the donor ability of the diluent. Thus the observed stoichiometric stability constants are lower in donor type diluents such as aromatic hydrocarbons and in acceptor type diluents such as chloroform than in aliphatic hydrocarbon diluents. (auth) (UK)

121 FORCE CONSTANTS AND BOND DISTANCES FOR THE U-O BOND OF URANYL SALTS. Garg, C. L.; Gupta, S. D.; Narasimham, K. V. (Defence Science Lab., Delhi). Indian J. Pure Appl. Phys.; 8: 108-10(Feb 1970).

The U-O force constants for several uranyl salts were calculated by Wilson's F-G matrix method using known vibrational data from fluorescence and infrared investigations. Making use of these force constants, the U-O bond distances were calculated with the help of Badger's formula and these values were found to be in very good agreement with those obtained from the formula of L. H. Jones [Spectrochim. Acta, 10 (1958), 395; 11 (1959), 409]. It was found from the results of several salts that the bond length decreases with the increasing value of the symmetric stretching frequency (ν_1) and that the sum of ν_1 and ν_3 (asymmetric stretching frequency) in each salt has a linear relationship with the value of the U-O force constant. (auth)

122 FLUORIDE CRYSTAL STRUCTURES. PART XII. TRIMERIC TECHNETIUM OXIDE TETRAFLUORIDE. Edwards, A. J.; Jones, G. R.; Sills, R. J. (Univ. of Birmingham, Eng.). J. Chem. Soc., A; No. 15, 2521-3(1970).

Technetium oxide tetrafluoride is dimorphic, having monoclinic and hexagonal forms. Crystals of the hexagonal form have space group $P6_3/m$, a = 9.00, c = 7.92 Å. The structure was refined by three dimensional least-squares methods, to R 0.108 for 368 independent reflections. In the crystal, octahedrally coordinated units are linked into trimers by cis-bridging fluorine atoms. The distorted octahedral arrangement around technetium is almost identical to that around molybdenum in the endless chain structure of molybdenum oxide tetrafluoride. (auth) (UK)

123 MAGNETIC PROPERTIES OF THE U^{4+} ION IN A Cl^- LIGAND FIELD WITH OCTAHEDRAL AND TETRAHEDRAL SYMMETRIES OVER THE TEMPERATURE RANGE 50 TO 1200°K. Mulak, J.; Jezowska-Trzebiatowska, B. (Inst. of Low Temperatures and Structure Research, Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 18: 283-8(1970).

The magnetic susceptibility of the U^{4+} ion was calculated over an extensive temperature range. Splitting diagrams and eigenfunctions of levels for the $^3H_4$ term of the U^{4+} ion in a ligand field with octahedral and tetrahedral symmetries are given. (M.C.G.)

124 CRYSTALLOGRAPHIC DATA ON DEFINED COMPOUNDS OF THE SYSTEM CsF-UO_2F_2-H_2O. Brusset, Henry; Nguyen Quy Dao (Ecole Centrale des Arts et Manufactures, Chatenay-Malabry, France). Compt. Rend., Ser. C; 271: 303-6 (27 Jul 1970). (In French).

The evaporation of cesium and uranyl fluoride solutions gave rise to four defined compounds: $Cs_3UO_2F_5$ (I), $Cs_2UO_2F_4$, H_2O (II), $CsUO_2F_3$, H_2O (III) and $CsUO_2F_3$ (IV). (I) crystallizes in a cubic system with a parameter a = 9.82 ± 0.05 Å. Space groups are: F23, (T^3) or F2/m3, (T_h^3). Experimental density is 4.95 ± 0.20. The existence of two lattices for (I) is explained. (II) crystallizes in a monoclinic lattice: a = 8.06 ± 0.10 Å; b = 12.18 ± 0.01 Å; c = 9.29 ± 0.02 Å; β = 109°12. (III) crystallizes in the following monoclinic lattice with: a = 6.04 ± 0.01 Å; b = 11.52 ± 0.02 Å; c = 9.43 ± 0.02 Å; β = 95°36. Space groups are identical for the compounds (II) and (III): $P2_1/c$; (C_{2h}^5). Powder patterns of (I), (II), and (III) are presented. (auth) (France)

125 EMF MEASUREMENTS ON ELECTRONIC CONVERSIONS IN THE SOLID ELECTROLYTE $Th_{0.8}Y_{0.2}O_{1.9}$. Ullmann, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Z. Phys. Chem. (Leipzig); 237: 274-7(1968). (In German).

EMF measurements were conducted on the following oxygen concentration chain: Pt, $O_2(p_1)$/Th0.8 $Y_{0.2}O_{1.9}$/$O_2(p_2)$, Pt. To obtain a defined oxygen partial pressure, one electrode was flooded with saturated hydrogen instead of water vapor at 20°C and at the other electrode inert gas with various amounts of oxygen flowed continuously. (H.B.G.)

126 RATIONALE FOR DYNAMICALLY INDUCED FORBIDDEN ELECTRIC DIPOLE TRANSITIONS OF Np^{4+} IN ThO_2. Menzel, E. R. (Univ. of Idaho, Moscow); Gruber, J. B. J. Chem. Phys.; 53: 4120-1(15 Nov 1970).

For the case of Np^{4+} in ThO_2 of cubic symmetry, it was concluded that the hard-sphere model makes the Hamiltonian not only a first approximation, but reasonably exact in form. If the Np^{4+} ion is displaced from the center of the cube, the attraction to the corner oxygens initially moves the Np^{4+} ion preferentially along a body diagonal. As the ions approach each other, however, the electron cloud overlap produces a repulsion, which deflects the Np^{4+} ion preferentially towards the center of a face of the cube. (M.C.G.)

Radiation and Nuclear Chemistry

Refer also to abstracts 63 and 64.

127 (CONF-700915-1) APPLICATION OF POSITRON ANNIHILATION AS A CHEMICAL PROBE. Ache, Hans J. (Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry). [1970]. 6p. Dep. NTIS.

From 6th International Symposium on Microtechniques, Graz, Austria.

The potential of positron annihilation and positronium formation as an analytical tool for solution of certain problems in chemistry is discussed. Examples of the use of this method include: phase transition studies, radioinduced solid-state reaction studies, and radiation defect studies in ionic crystals. (M.C.G.)

Radiation Effects

Refer also to abstract 387.

128 (COO-1617-26) REACTIONS OF SELECTED HALOGENS AND INTERHALOGENS ACTIVATED BY RADIATIVE NEUTRON CAPTURE AND ISOMERIC TRANSITION WITH CONDENSED STATE CYCLOPENTANE AND AROMATIC HYDROCARBONS. Kemnitz, Ernest John Jr. (Nebraska Univ., Lincoln. Dept. of Chemistry). 1970. Contract AT(11-1)-1617. 127p. Dep. CFSTI.

Thesis.

Cyclopentane, benzene, and selected alkylbenzenes were probed both in the liquid and solid phases with nuclear processes induced by the neutron activation of one or more of the following species: $^{127}I_2$, $^{129}I_2$, Br_2, ICl, and IBr. Of particular interest in each of the systems were: isotope effects due to radiative neutron capture (n,γ) and isomeric transition (IT) processes, individual and comparative scavenging effects in the liquid phase systems of the various halogens and interhalogens, crystalline structure at 77° K, and, product distributions of organic halides. The organic yields due to the $^{127}I(n,\gamma)^{128}I$ and $^{130m}I(IT)^{130}I$ processes in liquid cyclopentane were about 1.2 times greater than those due to the $^{129}I(n,\gamma)^{130}I + {}^{130m}I$ processes, whereas no differences were found when benzene and alkylbenzene were used as solvents. The product distribution was seemingly independent of the nuclear process in all the solvents employed, which lends support to Willard's autoradiation hypothesis. When ICl was used in solid state systems, it was found that ^{38}Cl organic yields were useful in determining concentrations at which clustering or fractional crystallization occurred, while ^{128}I organic yields were seemingly misleading. In the Br_2–benzene system at 77° K, two organic yield plateaus appeared with the isotopes studied, producing different but parallel curves. The study of isotope effects in solid state systems was found to require extremely high-purity components. Only the Br_2–benzene gave reliable data for this reason. The $^{79}Br(n,\gamma)^{80m}Br$, $^{81}Br(n,\gamma)^{82}Br + {}^{82m}Br$, and $^{82m}Br(IT)^{82}Br$ processes each produced a different organic yield at a given concentration of Br_2. In the liquid state where organic yields were found to be much less sensitive to trace impurities, scavenging was found in mixed- and interhalogen–benzene systems but not in I_2– and Br_2–benzene systems. The ^{38}Cl organic yields were not affected by phase or the presence of iodine while bromine organic yields lowered in the presence of iodine. ^{128}I organic yields were enhanced in the presence of chlorine and bromine, probably due to an increase in radical formation. The ^{128}I and ^{38}Cl organic yields in solid state I_2– and ICl–alkylbenzene systems resembled those in the analogous systems of benzene, indicating complex formation. The product distribution of the I_2–alkylbenzene systems indicated that the alkyl side chains are quite vulnerable to attack by hot atom processes. Methyl iodide was the major product in the several alkylbenzenes studied except in the case of ethylbenzene where ethyl iodide was equally abundant. A large amount of unstable, unlabeled organic iodide was formed in the I_2–ethylbenzene, –cumene, and –tert-butylbenzene systems. (auth)

129 (NP-18478) ELECTRON SPIN RESONANCE STUDIES ON IRRADIATED HETEROGENEOUS SYSTEMS. VI. THE STRUCTURE AND REACTIVITY OF PARAMAGNETIC CENTERS IN SILICA GEL. Kinell, Per-Olof; Komatsu, Tsuyoshi; Lund, Anders; Shiga, Tetsuo; Shimizu, Akira (Forskningradens Laboratorium, Studsvik (Sweden)). 1970. 32p. (LF-29). Dep. NTIS (U. S. Sales Only).

The paramagnetic centers formed in silica gel γ-irradiated at 77°K were identified from ESR spectra, microwave saturation behavior, optical and thermal bleaching properties, and influence of various gel pretreatments. Four main centers are formed, namely electrons trapped at oxygen vacancy sites at $g = 2.0008$, electrons trapped at a limited number of sites, whose nature is not at present quite clear at $g = 2.0030$, hole centers trapped on the surface of the silica gel and located near to nonbridging oxygen atoms at $g = 2.0070$, and finally centers attributed to holes located close to ^{27}Al nuclei at $g = 2.011$. The centers react with oxygen at 77°K during several months' storage. At 300°K the reaction is completed within 30 min and O_2^- radical ions are formed. Carbon dioxide present during the irradiation forms CO_2^- radicals by trapping electrons liberated in the silica gel, while the $g = 2.0070$ centers are unaffected. Except for electron transfer reactions, hole transfers also occur as indicated by cation radical formation in adsorbate molecules and simultaneous quenching of the $g = 2.0070$ hole centers. Further, a hydrogen atom transfer was demonstrated by the existence of neutral radicals formed by attachment of hydrogen atoms to adsorbate molecules. (auth)

130 (ORO-2968-56) RESEARCH CONCERNING IONIC AND FREE RADICAL REACTIONS IN RADIATION CHEMISTRY. Progress Report, September 15, 1969–September 15, 1970. Williams, T. Ffrancon (Tennessee Univ., Knoxville. Dept. of Chemistry). Contract AT(40-1)-2968. 14p. Dep. CFSTI.

Structure of the electron-excess centers formed by γ-irradiation in the two crystalline phases of acetonitrile was completely characterized by ESR studies on single crystals. The kinetics of decay of methyl radicals formed by photobleaching the electron-excess dimer centers in CH_3CN and CD_3CN at 77°K was studied. Radicals formed during the γ-irradiation at 77°K of trimethyl phosphate, dimethyl methylphosphonate, dimethyl phosphite, trimethyl phosphite, and phosphorus oxychloride were studied by ESR. Kinetics of γ-radioinduced polymerization of 2-vinyl pyridine was studied. (J.G.B.)

131 FLUORESCENCE EFFICIENCIES AND COLLISIONAL DEACTIVATION RATES FOR N_2 AND N_2^+ BANDS EXCITED BY SOFT X RAYS. Mitchell, Kenneth B. (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys.; 53: 1795-1802(1 Sep 1970).

Efficiencies for excitation of the 3914-Å N_2^+ first negative band and several prominent N_2 first positive bands and N_2 second positive bands were measured in pure nitrogen and air as a function of gas pressure. These nitrogen bands were excited by the deposition of monochromatic x rays in the energy range 0.9 to 8.0 keV. The efficiency for the 3914-Å band in air at pressures where there is no deactivation was determined to be 0.53% ± 0.07%. Efficiency in air was 0.21% ± 0.03% for the 3371-Å N_2 second positive band and 0.23% ± 0.08% for the 8912-Å N_2 first positive band. The efficiencies of the first negative and second positive bands were invariant for photon energies between 0.9 and 8.0 keV. Quenching of the 3914-Å band in pure nitrogen follows the Stern–Volmer relationship for two-body processes. The quenching constant K was 0.96 $torr^{-1}$ and the corresponding deactivation rate constant 4.53×10^{-10} cm^3/sec. The rate constant for the 3914-Å band, quenched by O_2, in air at low pressures, was 7.36×10^{-10} cm^3/sec. Three-body processes were evident in air at pressures above 100 torr. The deactivation of the $v' = 0$ vibrational levels in the second positive bands had a rate constant of 1.12×10^{-11} cm^3/sec by nitrogen and had a rate constant of 3.12×10^{-10} cm^3/sec by oxygen. Quenching constants were measured for seven first positive bands for the sequences $v' = 1-7$. The mean value of K, averaged over all v' sequences, was about 3 for nitrogen and 6.5 for air. The deactivation rate constant for the 8912-Å (1, 0) band quenched by N_2 was 8.4×10^{-12} cm^3/sec. (auth)

132 OBSERVATION OF ELECTRON-NUCLEAR TRIPLET RESONANCE FOR THE AsO_4^{4-} CENTRE IN X-RAY IRRADIATED SINGLE CRYSTALS OF KH_2AsO_4. Dalal, N. S.; McDowell, C. A. (Univ. of British Columbia, Vancouver). Chem. Phys. Lett.; 6: 617-19(15 Sep 1970).

In the course of extensive ENDOR studies on the AsO_4^{4-} center in x-irradiated single crystals of KH_2AsO_4, steady-state ENDOR transitions predicted earlier by Feher, and independently by Freed, and named Electron-Nuclear Triple Resonance by the latter, were observed. (auth)

133 ELECTRON SPIN RESONANCE OF ACTIVE SPECIES PRODUCED IN γ-IRRADIATED PROPYLENE AT −196°C. Nishimura, Hiromichi (Tokyo Univ.); Tabata, Yoneho; Oshima, Keichi; Tamura, Naoyuko. Kogyo Kagaku Zasshi; 73: 1227-33(Jun 1970). (In Japanese).

The primary process in the radioinduced solid-state polymerization of various monomers was investigated. Radical species produced by γ-irradiation were determined by an ESR spectrometer. The measurement was carried out by means of the matrix-isolation technique using rare gases. The reason why propylene does not polymerize at low temperatures and the behavior of radicals observed in γ-irradiated propylene are discussed. Only a

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five-line spectrum which is assigned to the allyl radical, was observed for γ-irradiated pure propylene at −196°C. It was found by photo-illumination of the allyl radical that the radical could be transformed partly into a short-lived n-propyl radical by isomerization and partly into the allenyl radical on detachment of a hydrogen molecule or two hydrogen atoms. No radicals were observed in γ-irradiated propylene dispersed in xenon in the concentration range of 20 to 80 mol %, however, methyl radicals and a small quantity of vinyl radicals were observed in γ-irradiated propylene dispersed in xenon matrices in concentration below 10 mol %. Both these radicals were not observed in γ-irradiated pure propylene. No polymer radical could be found both in γ-irradiated pure propylene and xenon−propylene mixture. (auth)

134 FLUORESCENCE AND PHOSPHORESCENCE PRODUCED BY ELECTRON-ION RECOMBINATION IN 3-METHYLPENTANE AT 77°K. Merkel, Paul B.; Hamill, William H. (Univ. of Notre Dame, Ind.). J. Chem. Phys.; 53: 3414-16 (1 Nov 1970).

Spontaneous luminescence and photoinduced luminescence from γ-irradiated 3-methylpentane (3MP) at 77°K were investigated. In addition to the previously reported band at 415 nm, a second band was observed in the emission spectrum at 230 nm and assigned to 3 MP fluorescence. The presence of the latter band confirms the existence of $3MP^+$ ion centers in neat 3MP. Measurements of the decay of recombination luminescence induced by a brief pulse of light indicate lifetimes of ≤2 msec for the 230-nm band and 4.4 sec for the 415-nm band. The decay of the fluorescence sets an upper limit on the rate of the electron-positive hole recombination in 3MP and establishes that the long decay time of the 415-nm band is intrinsic to the emission process itself. This phosphorescence is assigned to emission from the lowest triplet state of 3 MP. (auth)

135 NMR MEASUREMENTS ON ^{60}Co γ-RAY-IRRADIATED POLYTETRAFLUOROETHYLENE WITH HIGH RADIATION DOSES. Tutiya, Mituaki (Tokyo Metropolitan Isotope Research Center). Jap. J. Appl. Phys.; 9: 1204-9(Oct 1970).

The effects of ^{60}Co γ radiation and post-irradiation heat treatment on the NMR line of PTFE were studied over the temperature range −50 to 50°C for a total dose of 8.9×10^8R. Lowering of transition temperature associated with crystalline regions of PTFE, narrowing the line width of the broad component, broadening the line width of the narrow component, and the appearance of a very sharp line component were observed in the NMR line shape of the irradiated PTFE. When the irradiated PTFE was annealed near the melting temperature, the very sharp line component disappeared and the transition temperature shifted to higher temperature, differing from that of unirradiated PTFE. This difference is considered to be associated with the decrease in the average molecular weight of the irradiated PTFE. Changes resulting from post-irradiation heat treatment can be attributed to the removal of defects and low-molecular-weight products trapped within PTFE. No change was observed in the line width or narrow component by post-irradiation heat treatment. (auth)

136 EFFECT OF CRYSTALLINE FORM ON THE ELECTRON SPIN RESONANCE SPECTRUM OF gamma-IRRADIATED ACRYLONITRILE AT 77°K. OBSERVATION OF A PHOTOSENSITIVE CENTER IN THE LOW-TEMPERATURE PHASE. Chung, Yoon Jin; Takeda, Keiji; Williams, Ffrancon (Univ. of Tennessee, Knoxville). Contract AT(40-1)-2968. Macromolecules; 3: 264-5(Mar-Apr 1970). (ORO-2968-51).

The high-temperature and low-temperature phases of crystalline acrylonitrile were prepared for γ irradiation at 77°K. The ESR spectrum of the quenched γ-irradiated sample was a quintet of which the three broad lines in the center were prominent with a hyperfine splitting at ~25 G. This spectrum was assigned to the CH_2CHCN radical. The spectrum of the annealed sample was significantly different. A relatively intense triplet structure with a hyperfine splitting at 10.5 G was found. Apparently a different paramagnetic species is produced by γ irradiation of the low-temperature phase. (B.L.M.)

137 CHEMICAL EFFECTS OF THE (n,γ) REACTIONS IN DICHLOROTRIETHYLENE TETRAMINE COMPLEXES OF COBALT (III) AND RHODIUM(III). Gardner, E. R. (Leicester Polytechnic, Eng.); Greethong, S.; Raynor, J. B. Radiochim. Acta; 14: 23-7(1970).

Cis-Co(III) and Rh(III) dichlorotriethylene tetramine chloride, which were labeled with ^{36}Cl in the anion and cation, trans-dichlorotriethylene tetramine Co(III) chloride labeled with ^{36}Cl in the anion and cation, and cis- and trans-dichlorotrien Co(III) chloride labeled with ^{60}Co in the metal atom, were irradiated with thermal neutrons in a flux of 10^{11} neutrons cm^{-2} sec^{-1} for ten hours. Study of the effects of the (n,γ) reaction showed that in the case of cis-dichlorotriethylenetetramine Co(III) chloride after irradiation, the amount of new product cations is about five times (by Cl labeling) to seven times (by Co labeling) the amount of original cation left. Trans-dichlorotriethylene tetramine Co(III) chloride and cis-dichlorotriethylene tetramine Rh(III) chloride show a ratio of 2:1 new product cations to original cation as measured by Co labeling. When the anions were considered, it was shown that with cis-dichlorotriethylene tetramine Co(III) chloride the amount of chloride ion left after irradiation is about half of the starting amount. Trans-dichlorotriethylene tetramine Co(III) chloride showed about the same amount of chloride ion left after irradiation as before irradiation, while cis-dichlorotriethylene tetramine Rh(III) chloride showed about one half to three-quarters of the chloride ion present after irradiation. A unique feature of the results is that from 200,000 to 500,000 Metal−Cl bonds are broken for each n,γ reaction, suggesting that the Harbottle and Sutin hot zone model must be expanded to include a larger number of molecules. (auth)

138 FLUORESCENCE SPECTRA OF POLYSTYRENE EXCITED BY BETA RAYS AND UV LIGHT. Witt, H.; Rheude, A.; Heusinger, H. (Technische Hochschule, Garching, Ger.). Radiat. Eff.; 5: 213-20(Oct 1970).

Monomer-free polystyrene samples, produced by evaporation from a solvent excluding oxygen show, by excitation with uv-light (λ = 270 nm) or with β rays, besides the excimer peak at 330 nm (P-peak) an additional fluorescence peak at 390 nm (G-peak). This peak disappears by melting of the sample or admission of air. The influence of additives on the fluorescence spectra was investigated. 1,2-di-(2-pyridyl)-ethylene, an efficient quencher for the first excited singlet state of polystyrene, reduces the P-peak much more than the G-peak. Therefore it is improbable that the states responsible for the P- and G-peak are excimers of different distance or symmetry of the segmers or excimers with more than 2 segmers participating. The intensity of the G-peak in comparison to the P-peak increases by addition of low concentrations of hexachlorocyclohexane ($c < 10^{-5}$ mole/l). The dependence on the structure of the polymer and the influence of the electron scavenger suggests that the appearance of the G-peak is connected with the existence of electron traps. It is assumed that the origin of the G-peak is a charge separate state analogous to that proposed by Janssen and Funabashi to explain the luminescence in γ-irradiated alkane glasses. (auth)

139 ELECTRON RELEASE FROM GAMMA-IRRADIATED SILICA GEL. Rama Rao, K. V. S.; Iyer, R. M. (Bhabha Atomic Research Centre, Trombay, India). Radiat. Eff.; 5: 269-71 (Oct 1970).

Postirradiation reactions of silica gel with nitrous oxide at various concentrations of N_2O coverage have been studied to assess long-range electron migration in solids. It is shown that $GN_{(2)}$ reaches a constant value of 0.39 at and above 35 per cent surface coverage. The intensity of the ESR spectra of irradiated silica gel is reduced to ⅓ on adsorption of ethane while N_2O completely removes it. N_2O is decomposed even when a barrier layer of ethane or hydrogen is adsorbed over silica gel indicating transmission of electrons through these barrier molecules. The significance of these observations is discussed. (auth)

Radiation Processes

Refer also to abstract 133.

140 (AAEC/LIB/Bib-254) RADIATION TREATMENT OF SEWAGE. Newland, E. A. (comp.) (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Sep 1970. 8p. Dep. CFSTI (U. S. Sales Only).

Forty-seven references are listed covering the period 1948 to 1970. The references are listed chronologically by year and alphabetically by author within each year. Where applicable, reference is made to an abstract for each article. (Australia)

141 (ORO-3781-7) INVESTIGATION OF GAMMA-RAY INDUCED POLYMER FORMATION OF THE CARBORANES. Annual Progress Report. Klingen, Theodeore J. (Mississippi Univ., University. Dept. of Chemistry). 1 Nov 1970. Contract AT(40-1)-3781. 46p. Dep. NTIS.

Research on the γ-radioinduced polymerization of substituted o-carboranes (indexed as 1,2-dicarbadodecaborane) was continued. The radioinduced polymerization of 1-vinyl-o-carborane led to one product, a polymer that has been characterized in previous studies. An unsuccessful attempt was made to determine the melting point of the polymer. An increase in temperature was found to result in an increase in number average molecular weight of the polymer. Mass spectral analysis of yields of the radiolysis of 1-isopropenyl-o-carborane indicates that polymerization does not proceed much beyond the dimer stage. Dimer

products were characterized. Preliminary studies on the radio-induced polymerization of 1-allyl-o-carborane and 1-ethyl-o-carborane are underway. Attempts were made to characterize the structure of 1-ethyl-o-carborane. Studies indicate that radiolysis does not cause significant interconversion of the ortho, meta, and para isomers of the carboranes. (J.G.B.)

142 (TID-25513) INTERACTION AND LINKAGE OF POLYCYCLIC HYDROCARBONS TO NUCLEIC ACIDS. Lesko, Stephen A. Jr.; Hoffmann, Hans D.; Ts'o, Paul O. P.; Maher, Veronica M. (Johns Hopkins Univ., Baltimore, Md. Dept. of Radiological Sciences). [1970]. Contract AT(30-1)-3538. 49p. De[illegible]. CFSTI.

Research is reported on a continuing effort to find an informative model system with conditions sufficiently similar to those which exist in cells to establish a correlation between carcinogenicity and the extent of covalent attachment of hydrocarbons to DNA. Studies on the in vitro interaction of benzo[a]pyrene with nucleosides, nucleotides, and nucleic acids are reviewed. The reactions were induced by physical agents (x and uv radiation) or chemical reagents (iodine and hydrogen peroxide–ferrous ion). The photoinduced formation of tritiated benzo[a]pyrene-nucleohistone was investigated. Results indicate that about 10% of the radioactivity is chemically linked to isolated histones and that about 10% is chemically bound to a small fraction of the original nucleohistone containing both DNA and protein. The base specificity of the chemically induced covalent linkage of polycyclic hydrocarbons to nucleic acids was examined using homopolynucleotides and their double-stranded complexes as model systems. A mixture of tritium-labeled benzo[a]pyrene and carbon-14-labeled benzo[a]pyrene was used to synthesize 5-hydroxy-benzo[a]pyrene. Incubation of the labeled product with DNA and poly G led to a covalent linkage in the absence of an activation system. Radioactivity measurements indicate that the ratios of chemically linked hydrocarbon to the bases of nucleic acid are about 1:800 for DNA and about 1:300 for poly G. Results of analysis by sucrose gradient electrophoresis suggest the presence of hydrocarbon-oligoguanine molecules. (J.G.B.)

143 OPERATING EXPERIENCE WITH THE RS-2.5 RADIATION-CHEMICAL SULFOCHLORINATOR. Dzhagatspanyan, R. V.; Osipov, V. G.; Solodikhina, L. D.; Lyaskin, Yu. G.; Gershenovich, A. I. This paper was summarized in At. Energ. (USSR); 25: 314-15(Oct 1968) as paper No. 232. (In Russian).

The results of tests run on the RS-2.5 radiation process sulfochlorinator under full-scale industrial conditions are presented. Data on contents of product in the reaction mixture with hydrocarbon feed after 25% conversion and with intermittent hydrocarbon feed are presented graphically. A formula is given for calculation of the throughput of the sulfochlorinator from a material balance. (B.L.M.)

144 STUDY OF TEXTURES OF POLYETHYLENE POLYMERIZED BY γ-RAY IRRADIATION IN GAS PHASE. Hosoi, Masahiro (Tokyo Inst. of Tech.); Kawai, Toru; Kuriyama, Isamu. Sen'i Gakkaishi; 26: No. 2, 66-73(Feb 1970). (In Japanese).

Textures of polyethylene polymerized by γ irradiation in gas phase were studied by electron microscopy, thermal analysis, x-ray analysis including the effects of annealing and fuming nitric acid treatment. Electron microscopy revealed that the as-polymerized polyethylene consisted of irregular aggregation of ill-defined lamallae. Fibrillar network was occasionally observed, but these are considered to be the result of some mechanical action during or after the polymerization. DTA thermograms and the peak temperature also suggest that the crystals formed are unstable showing rather low peak temperature (120.4°C to 125.2°C) and that the lower the polymerization temperature, the more unstable. The effect of the fuming nitric acid treatment (for instance, weight loss) is larger for the product of polymerization at lower temperature. The branch content was higher for the product at higher temperature; however, the x-ray crystallinity and the peak temperature were lower for the product at higher temperature. The residue of the fuming nitric acid treatment showed higher crystallinities than the original samples, and the crystallinity and melting temperature of the etched crystals of the higher temperature product became higher than that of the lower temperature product. Moreover annealing of the 30°C product gives rise to much higher increased crystallinity (as revealed by the weight loss due to the etching) than that of 90°C product. The size of the individual lamellar crystals as revealed by an x-ray method seems bigger for high-temperature product. The effects of the branching of the polymerization temperature are opposed by those of the crystallization (polymerization) temperature. (auth) (Japan)

145 KINETICS OF THE RADIATION-CHEMICAL CIS-TRANS TRANSFORMATION. Schwab, G.-M.; Ehrl, A. (Univ., Munich. Gesellschaft fuer Strahlenforschung mbH, Neuherberg, Ger.). Z. Phys. Chem. (Frankfurt); 69: 317-22(Jun 1970). (In German).

For the transformation of trans- to cis-stilbene and the reverse in solutions by ^{60}Co γ radiation, kinetic expressions were developed, which show the energy transition. A G-value of 1 mole/100 eV was calculated. (M.C.G.)

146 EFFECT OF MAGNETIC FIELD ON RADIATION INDUCED SOLID STATE POLYMERIZATION OF ACRYLONITRILE AT LOW TEMPERATURE. Mori, Koichi; Tabata, Yoneho; Oshima, Keichi (Tokyo Univ.). Kogyo Kagaku Zasshi; 73: 1215-20(Jun 1970). (In Japanese).

The radioinduced solid-state polymerization of acrylonitrile at 77°K was studied under the influence of magnetic field of 0 to 5,000 gauss. The polymerization yield increased with radiation dose at 77°K, and the yield reached a saturation with low conversion. With increasing magnitude of the applied magnetic field, the initial rate of polymerization and the yield in the saturation increased and became maximum at about 4,000 gauss, and then decreased. The molecular weight of the polymer decreased with irradiation dose, but was unaffected by the magnetic field. The number of polymers increased with increasing magnitude of the applied magnetic field below about 4,000 gauss and then decreased with increasing magnitude of the applied magnetic field above 4,000 gauss. It seems that the magnetic field has a strong influence on the initiation stage of the polymerization. A model of collective excitation process should be taken into consideration to explain the effect of magnetic field on the polymerization. (auth) (Japan)

147 ELECTRON SPIN RESONANCE OF PRIMARY PROCESS IN RADIATION INDUCED SOLID STATE POLYMERIZATION OF ETHYLENE BY MATRIX-ISOLATION TECHNIQUE. Nishimura, Hiromichi (Tokyo Univ.); Tabata, Yoneho; Oshima, Keichi; Tamura, Naoyuki. Kogyo Kagaku Zasshi; 73: 1220-7 (Jun 1970). (In Japanese).

The primary process in the radioinduced polymerization of ethylene was studied by measuring the ESR of various γ-irradiated monomers dispersed in xenon matrices at low temperatures. The main radical species, which was observed in the ESR spectra of both γ-irradiated pure ethylene and xenon–ethylene mixture, was the ethyl radical. But the concentration of ethyl radicals in xenon matrices with a broad line-width decreased very rapidly even at −196°C, and after their disappearance a broad and well-resolved spectrum was obtained, which may be assigned to the polymer (oligomer) radical. This polymer radical was found to isomerize on illumination with uv light of wavelength more than 3,000 Å, and the isomerized radical species had a well-resolved six-line spectrum, which could be reversibly transformed into the former broad spectrum after storage in liquid nitrogen. During γ-irradiation of ethylene in xenon, a very remarkable energy transfer from xenon to ethylene monomer took place. (auth) (Japan)

148 ELECTRON SPIN RESONANCE OF ACTIVE SPECIES PRODUCED IN γ-IRRADIATED ISOBUTYLENE IN XENON MATRICES. Nishimura, Hiromichi (Tokyo Univ.); Tabata, Yoneho; Oshima, Keichi; Tamura, Naoyuki. Kogyo Kagaku Zasshi; 73: 1233-9(Jun 1970). (In Japanese).

The matrix-isolation technique was applied to investigate the primary process in the radioinduced solid-state polymerization of various monomers. Radical species produced by γ-irradiation were determined by an ESR spectrometer. The behavior of active species produced in both pure isobutylene and xenon–isobutylene mixture by γ-irradiation is described. A ten-line spectrum with broad line-width was observed in γ-irradiated pure isobutylene at −196°C. This spectrum is assigned to the tert-butyl radical. On the other hand, in γ-irradiated isobutylene dispersed in xenon matrices, a fifteen-line spectrum was observed in addition to the ten-line spectrum. The fifteen-line spectrum is assigned to a polymer radical. It was found that the fifteen-line spectrum could be eliminated by uv ($\lambda > 3000$ Å) irradiation, and that the tert-butyl radical was transformed into the allyl radical by uv ($\lambda > 2800$ Å) irradiation. In the latter case, a molecular detachment is considered to take place as follows, $(CH_3)_3C \cdot \xrightarrow[(\lambda>2800A)]{h\nu} CH_2=C(CH_3)=CH_2 + H_2$ (or 2H). (auth) (Japan)

149 DIFFUSION OF GASES AND WATER VAPOR THROUGH GRAFTED POLYOXYMETHYLENE. Williams, J. L.; Stannett, V. (Research Triangle Inst., Research Triangle Park, N. C.). J. Appl. Polym. Sci.; 14: 1949-59(Aug 1970).

Polyoxymethylene was successfully grafted with styrene, butadiene, and acrylonitrile by the mutual γ irradiation method in the monomer containing 18% of dimethylformamide. The CO_2 and water vapor permeabilities and diffusivities were determined in the case of the butadiene- and acrylonitrile-grafted

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products. The former grafts had higher permeabilities than the ungrafted materials. However, the acrylonitrile grafts showed considerably reduced water vapor permeability and diffusivity compared to the ungrafted polyoxymethylene. Films made by grafting to polymer powder and compression molding showed lower permeabilities compared to those made by direct grafting to polyoxymethylene films. (auth)

150 RADIATION PROCESSED FIBRE-POLYMER COMBINATIONS. Mani, R. S.; Jayaraman, T. M.; Thacker, R.; Aggarwal, K. S. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Technol.; 7: 16-22(Jan 1969).

The possibility of treating cheaper varieties of wood and other fibrous materials like bamboos and bagasse-boards by radiation polymerization of the plastic monomers inside the fiber structure, so as to improve their mechanical strength and durability, was investigated. The fiber–polymer combination was achieved by first soaking the material in a suitable plastic monomer, after which it was polymerized by exposure to gamma rays, avoidance of high temperatures, and the use of catalysts. Pronounced improvements in appearance, toughness, hardness, abrasion resistance, and dimensional stability were achieved. The monomer tried was styrene, to which plasticizers, catalysts, or naturally occurring polyesters like dehydrated castor oil were added in varying proportions. A technique based on preheating the impregnated sample prior to irradiation or using preheated styrene itself for impregnation was found to reduce the radiation dose requirement to 3.5 Mrads. Comparative studies using thermocatalytic and radiation techniques were carried out and optimum conditions worked out for the production of fiber–polymer combinations using styrene. (auth)

151 CHLORINATION OF TOLUENE, CHLOROTOLUENE, AND CHLOROBENZENE UNDER γ-RAY IRRADIATION. Kim, You Sun; Do, Jae Bum (Atomic Energy Research Inst., Seoul). J. Nucl. Sci. (Seoul); 10: No. 1, Pt. 1, 23-30(Jun 1970). (In Korean).

The chlorination of ö-chlorotoluene, toluene, and chlorobenzene was studied at 20 to 25°C under γ irradiation applying a dilute reaction system of carbon tetrachloride and chlorine. Both toluene and o-chlorotoluene gave a high yield of the side chain chlorination product when the reaction was done in a system of a small excess of chlorine or short reaction interval. However, the ring chlorination product was increased when the reaction was done in a large excess of chlorine or long reaction interval. Chlorobenzene gave mainly ring addition product when the chlorination was done in the large excess of chlorine or prolonged reaction time, whereas the ring-substituted product was increased when the reaction was done in a small excess of chlorine or short reaction interval. The feasibility of this reaction for synthetic use is discussed. (auth)

152 RADIATION-SENSITIZED PYROLYSIS OF DIETHYL ETHER. FREE-RADICAL REACTION RATE PARAMETERS. Hoehlein, G.; Freeman, G. R. (Univ. of Alberta, Edmonton). J. Amer. Chem. Soc.: 92: 6118-25(21 Oct 1970).

The γ-induced pyrolysis of diethyl ether was studied at pressures from 35 to 2100 torr and temperatures from 84 to 403°. The ether decomposed by a chain mechanism to form $CH_3CHO + C_2H_6$ at temperatures above 84°C; above 230°C a second chain formed C_2H_4 and presumably C_2H_5OH. The ethylene yield increased from 1 to 6% of the ethane yield as the temperature was increased from 257 to 403°C. Hydrogen was not a chain product. The pressure and temperature dependences of the various product yields are consistent with the proposed free-radical mechanism. The following reaction rate parameters were determined. $CH_3\dot{C}HOC_2H_5 \rightarrow CH_3CHO + C_2H_5$ (7), $\log k_7\ (sec^{-1}) = (9.7 \pm 1.1) - (16{,}000 \pm 2{,}000)/2.3\ RT$; $C_2H_5 + C_2H_5OC_2H_5 \rightarrow C_2H_6 + CH_3\dot{C}HOC_2H_5$ (8), $\log k_8[cm^3/(mol\ sec)] = (11.9 \pm 0.2) - (10{,}500 \pm 500)/2.3\ RT$; $C_2H_5 + CH_3CHO \rightarrow C_2H_6 + \dot{C}H_3\dot{C}O$ (13), $\log k_{13} = (12.1 \pm 0.6) - (8{,}500 \pm 1{,}500)/2.3\ RT$; $\dot{C}H_2CH_2OC_2H_5 \rightarrow C_2H_4 + C_2H_5O$ (20), $E_{20} = 22 \pm 4$ kcal/mol. The frequency factor and activation energy of reaction 7 are much lower than earlier estimates, but $E_7 = 16 \pm 2$ kcal/mol is still much greater than the heat of reaction, $\Delta H_7 \approx 5$ kcal/mol. The large negative entropy of activation, $\Delta S^{\ddagger} = -17 \pm 5$ cal/(deg mol), is not readily understood on the basis of current knowledge, but it is consistent with information derivable from other careful studies of radical decomposition reactions. (auth)

153 KINETICS OF RADIATION POLYMERIZATION OF VINYL BENZOATE. Kumar, V.; Rao, K. N.; Shankar, J. (Bhabha Atomic Research Centre, Trombay, India). Radiat. Eff.; 5: 227-31(Oct 1970).

Vinyl benzoate was polymerized by γ radiation from a cobalt-60 source and the kinetics of polymerization were studied at several temperatures. The results showed that the rate of polymerization was proportional to $I^{0.66}$, where I is the radiation dose rate. The net activation energy for the polymerization reaction, ($E_p - \frac{1}{2} E_t$), was found to be 3.62 kcal, where E_p and E_t are the activation energies for the propagation and termination stages of the reaction. The radical yield measured by the loss of DPPH in the solution after irradiation was G = 5.0, while the G (Radical) effective in initiating polymerization was 0.94. The ratio of the rate constants, $k_p^2/k_t = 5.8 \times 10^{-4}$ at 60° and 1.59×10^{-4} at 25°. The rate of polymerization was higher than that of styrene but lower than that of vinyl acetate under comparable conditions. (auth)

154 DELAYED LUMINESCENCE IN MOLECULAR SOLIDS. Kieffer, F.; Magat, M. (Faculte des Sciences, Orsay, France). pp 135–89 of Actions Chimiques et Biologiques des Radiations. /Haissinsky, M. Paris; Masson et Cie, Editeurs (1970). (In French).

Following an introduction and historical review, the following topics are discussed: experimental methods, origin of delayed luminescence, trapped electrons and anions, cations and delayed luminescence spectra in vitreous solutions, delayed luminescence spectra in pure compounds, mechanism of emission, relation of fluorescence and phosphorescence intensities in thermoluminescence, delayed luminescence in saturated molecules, isothermal decrease in delayed luminescence, thermolunimescence, activation energy in thermoluminescence, phase change and diffusion, nature of physical traps, mean distance between cations and trapped electrons, course of low-energy electrons during thermalization, saturation phenomena, and migration of positive charges and the nature of the cations. (198 references) (E.J.H.)

Radiolysis

Refer also to abstracts 449 and 1263.

155 (ORNL-TM-3144) FLUORINE PRODUCTION AND RECOMBINATION IN FROZEN MSR SALTS AFTER REACTOR OPERATION. Haubenreich, P. N. (Oak Ridge National Lab., Tenn.). 30 Sep 1970. 36p. Dep. NTIS.

Exposure of capsules of MSR fuel salts in the MTR between 1961 and 1964 showed that when the salt was chilled below about 80°C, F_2 was produced by radiolysis at a rate of 0.02 molecules/100 ev. Other experiments confirmed the radiolysis of frozen salt and provided data on the effect of temperature on recombination. The data on yield and recombination have recently been reviewed and used in answering questions involved in storing and disposing of irradiated salt from the MSRE and future molten-salt reactors. The energy source in the MSRE salt is low enough that no fluorine evolution is expected for over a year after heating to induce recombination. Salt from a high-power MSR can be stored in bare cans with no fluorine evolution if the surroundings are kept at about 200°F. (auth)

156 (RHEL/R-196) GAS EVOLUTION FROM EPOXY RESINS BY HIGH ENERGY RADIATION. Morgan, J. T.; Scott, G.; Sheldon, R.; Stapleton, G. B. (Rutherford High Energy Lab., Chilton (England)). Aug 1970. 30p. Dep. NTIS (U. S. Sales Only). UK 4s. 6d.

The changes in mechanical properties and the rate of gas evolution during irradiation were determined for a number of cast epoxy resin systems. The gas evolution rate is approximately constant up to 3000 Mrad and mass spectrometric analysis shows that the gases evolved consist chiefly of hydrogen, carbon monoxide, and carbon dioxide together with small quantities of lower hydrocarbons. G values for the evolution of the various gases are given and these results together with ir absorption studies indicated the types of reaction likely to be involved in the radiolysis of epoxy resins. Flexural tests were used to assess the changes in mechanical properties and these were determined after irradiation up to 4000 Mrad in air and 3000 Mrad in vacuum. (auth) (UK)

157 (UCLA-12-792) EPR STUDIES ON TRAPPED SPECIES PRODUCED IN THE GAMMA RADIOLYSIS OF AQUEOUS SUGAR ICES. Zimbrick, J. D.; Myers, L. S. Jr. (California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology). [1970]. Contract AT-04-1-GEN-12. 50p. Dep. NTIS.

The yields, EPR spectral characteristics, and paramagnetic relaxation of trapped electrons (e_T^-) and sugar radicals were studied in ^{60}Co γ-irradiated monosaccharide ices at 77°K. The e_T^- yields in the various ices ranged from 0.95 to 1.8 and were strongly dependent on solute molarity and phase of the ice matrix. In most cases the sugar radical yields were the same as the e_T^- yields. The e_T^- could be bleached with white light to form dielectrons as previously found for e_T^- in alkaline ices. The EPR lineshapes, linewidths, and line broadening mechanisms of e_T^- in the sugar ices were similar to the corresponding characteristics of e_T^- in alkaline ice. Spectral studies on the trapped sugar radicals indicated that two groups of radicals were present. The variation of the e_T^- and

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sugar radical relaxation times with radiation dose was studied in H_2O and D_2O matrices. The results for e_T^- were interpreted as indicating a spatially nonuniform distribution of this species; the spatial nonuniformity is not as great in the D_2O matrix as in the H_2O matrix. The results for the sugar radicals suggested that one group was distributed uniformly whereas the other group was distributed nonuniformly to the same degree as the e_T^- distribution. (auth)

158 COMMENT ON PHENOMENA INVOLVING NEUTRON CAPTURE BY SELECTED COBALT COMPLEXES. Khorana, S. (Carleton Univ., Ottawa). Radiochim. Acta; 13: 222(Jun 1970).

The work of various people on the effects of neutron irradiation on cobalt complexes is reviewed. Special attention is given to the reactions of Co(II)-EDTA and Co-(II)-glycinate. Exchange reactions of Co^{2+} with these complexes in solutions are discussed. Seventeen references are cited. (B.L.M.)

159 ROLE OF CO BOND SCISSION IN THE RADIOLYSIS OF CRYSTALLINE CARBOXYLIC ACIDS. McCalley, Roderick C.; Kwiram, Alvin L. (Harvard Univ., Cambridge, Mass.). J. Chem. Phys.; 53: 2541-2(15 Sep 1970).

It is demonstrated that the CO bond scission may be the main fragmentation path for negative primaries in the radiolysis of carboxylic acids. (M.C.G.)

160 YIELD OF IONS AND EXCITED STATES PRODUCED IN THE RADIOLYSIS OF POLAR ORGANIC LIQUIDS. Hayon, E. (Army Natick Labs., Mass.). J. Chem. Phys.; 53: 2353-8 (15 Sep 1970).

The yield of ions and triplet excited states produced in the radiolysis of polar protic and aprotic organic liquids was studied using the technique of pulse radiolysis. Anthracene and naphthalene were used to determine the yield of electrons and triplet excited states, respectively. Taking $\epsilon_{max} = 9.9 \times 10^3\ \underline{M}^{-1} \cdot cm^{-1}$ for $(anthracene)^-$, the yields of anthracene anions, considered to represent the yield of free ions produced, were found to vary from G values 0.1 to ~2.6 for the 20 organic liquids examined. The yields of triplet states were found to depend, in a number of cases, upon the presence of electron scavengers in the liquids. The liquids studied include p-dioxane, MTHF, pyridine, aliphatic alcohols, acetone, benzonitrile, acetonitrile, methylsulfoxide, 1,2-propanediol carbonate, dimethylformamide, dimethylacetamide, and N-methylpropionamide. The static dielectric constant values of these liquids ranged from ~2.0 to 165.0. These results are evaluated and discussed, and the potential interest of some of these liquids is indicated. (auth)

161 VALIDITY OF TRITIUM TRACERS. STABILITY OF TRITIUM ATOMS IN PURINES, PYRIMIDINES, NUCLEOSIDES, AND NUCLEOTIDES. Evans, E. Anthony; Sheppard, Hilary C.; Turner, John C. (Radiochemical Centre, Amersham, Eng.). J. Label. Compounds; 6: 76-87(Jan-Mar 1970).

The effect of pH and temperature on the stability of tritium atoms at various positions in purines, pyrimidines, nucleosides, and nucleotides is discussed. The importance of recognizing several types of instability is stressed. The formation of a hydrate on storing solutions of tritiated uridine and other results of the self-radiolysis of tritiated precursors of the nucleic acids are described. Alcohol solutions and low temperatures are recommended for minimizing self-decomposition. (auth)

162 PRODUCTION OF HYDROGEN ATOMS IN IRRADIATED FROZEN AQUEOUS ALCOHOL SOLUTIONS. AN ESR STUDY. Chandra, R. (Massachusetts General Hospital, Boston). Int. J. Radiat. Biol.; 17: 497-9(1970).

Various aqueous organic systems were exposed to gamma irradiation by means of a ^{60}Co source at a dose rate of 1.47 M rads/hr and stabilized hydrogen atoms were observed at 77°K using ESR. The following results are presented: first derivative ESR spectra of irradiated (1 Mrad) frozen aqueous methanol (45 of W/W) at 77°K; variation of hydrogen atom yield as a function of alcohol concentration for methanol, ethanol, and propanol; and the G(H) value at the maximum for methanol, ethanol, propanol, and isopropanol compared with 1 $\underline{M}$ solutions of $MH_4H_2PO_4$, NaH_2PO_4, N_2HPO_4, and Na_2SO_4. (UK)

163 KINETICS OF POLARON DECAY IN PULSE RADIOLYSIS OF CRYSTALLINE ICE. Pernikova, T. E.; Kabakchi, S. A.; Shubin, V. N.; Dolin, P. I. (Inst. of Electrochemistry, Moscow). Radiat. Eff.; 5: 133-4(Aug 1970).

The polaron decay is assumed to be due to the parallel occurrence of first- and second-order processes, and its kinetics were studied at 273 to 213°K. A graph of the rate, dc/dt, at time t = 0 (end of radiolysis pulse) showed the assumption to be correct. For the second-order process, E = 3.0 kcal/mole and $K^\circ = 2.5 \times 10^{13}$ l/mole sec, and the Arrhenius dependence is nonlinear. For the first-order process, the Arrhenius law is obeyed, E = 11.6 ± 2 kcal/mole, and the pre-exponential factor is $5.4 \times 10^{14}\ sec^{-1}$. If the monomolecular decay is assumed to occur via polaron dissociation to form a zonal electron, an activation energy of 10 to 14 kcal/mole is predicted, in agreement with the experimental value. (D.L.C.)

164 SOLVATED AND STABILIZED ELECTRONS IN RADIATION-CHEMICAL PROCESSES. Eiben, Klaus (Kernforschungszentrum, Karlsruhe, Ger.). Angew. Chem., Int. Ed. Engl.; 9: 619-32(Aug 1970).

The electrons solvated in metal–ammonia solutions are relatively stable; by contrast, hydrated electrons are very unstable and were discovered only recently during radiolysis of water. They can be regarded as the simplest radicals. Radiation-chemical production of solvated electrons has proved to be a method for qualitative and quantitative investigation of the reactions between these electrons and numerous compounds, whose rates are partly controlled by diffusion. It was possible in some cases to identify optically and ESR-spectroscopically the resulting short-lived products (radical anions). The similarity between the physical and chemical properties of electrons solvated in solutions and those of electrons stabilized in the solid phase suggests that the two species are identical. (auth)

165 ELECTRON STABILIZATION AND IONIC REACTIONS IN IRRADIATED KETONES. Revina, A. A.; Borisenko, G. L.; Bakh, N. A.; Kostin, A. K. (Inst. of Electrochemistry, Moscow). Dokl. Akad. Nauk SSSR; 191: 845-8(1 Apr 1970). (In Russian).

A series of dialkyl ketones and methyl ketones were irradiated with gamma quanta from ^{60}Co at 77, 193, and 360°K. The alcohol yield and yield of radicals were determined from electron paramagnetic spectra (EPR). The G value of alcohol at 77°K was found to be 0.3 for methyl propyl ketone, 0.3 for methyl butyl ketone, 0.7 for diethyl ketone, and 0.4 for dibutyl ketone. The corresponding G values for the production of radicals were found to be 4.1, 2.3, 3.2, and 1.6 for dibutyl ketone. A comparison of results obtained by the EPR method and by pulse radiolysis led to the conclusion that stabilization of radicals in the form of a complex is more likely in dialkyl ketones than in methyl ketones, as was also indicated by the higher yield of alcohol in the dialkyl ketones. It is proposed that a primary cation radical is first formed under the action of radiation. A hydrogen atom is then added to this primary cation radical to give a protonated ketone which is ultimately converted to a secondary alcohol. This mechanism satisfactorily explains the disappearance of radicals on subsequent illumination with light. (TTT)

166 γ-RADIOLYSIS OF ZEOCARB 225 CATION-EXCHANGE RESINS. Clay, P. G.; Hall, G. R.; Rahman, M. K.; Rashid, M. (Imperial Coll. of Science and Tech., London). J. Appl. Polym. Sci.; 14: 2167-70(Aug 1970).

Irradiation of Zeocarb 225 cation-exchange resin leads to a loss of exchange capacity and the formation of SO_4^{2-} ions. $G(SO_4^{2-})$ is dependent upon the relative amount of water associated with the resin and may be reduced by the addition of scavengers, reactive towards hydroxyl radicals. The results suggest that both direct and indirect radiolyses are able to bring about desulfonation and that hydroxyl radicals are responsible for the indirect radiolysis. (auth)

167 DIRECT OBSERVATION OF ELECTRON DISAPPEARANCE IN PULSE-IRRADIATED FLUOROCARBON GASES. Fessenden, Richard W.; Bansal, Krishan M. (Carnegie-Mellon Univ., Pittsburgh). J. Chem. Phys.; 53: 3468-73(1 Nov 1970).

A microwave conductivity detector was used to follow electron disappearance in pulse-irradiated fluorocarbon gases. A discussion of the application of the method to compounds of widely differing electron attachment rate constants and a number of experimental details are given. Eleven simple fluorocarbons, CH_2Cl_2, and SF_6 were studied. Because (except for SF_6) these compounds were relatively unreactive, considerable effort was expended on purification. In many cases the rate of electron attachment found for the purified sample was orders of magnitude less than for the unpurified one. In the homologous series from CF_4 to $n\text{-}C_4F_{10}$ only the latter was found to attach electrons at an appreciable rate ($k = 9.6 \times 10^{-12}\ cm^3\ molecule^{-1} \cdot sec^{-1}$). Significantly, CF_4 and C_2F_6 were found to have rate constants $<10^{-16}\ cm^3\ molecule^{-1} \cdot sec^{-1}$. The attachment rates of the compounds CH_2F_2, CHF_3, $CClF_3$, and CH_3CF_3 are all comparable; those of the last three are nearly identical ($4-5 \times 10^{-14}\ cm^3\ molecule^{-1} \cdot sec^{-1}$) suggesting the involvement of the CF_3 group. The electron attachment rate constant for SF_6 was determined to be $2.2 \times 10^{-7}\ cm^3\ molecule^{-1} \cdot sec^{-1}$. (auth)

168 RADIOLYSIS OF COBALT HEXAMINE NITRATE IN KCl, KBr, AND KI MATRICES. Srivastava, S. B.; Sarpotdar,

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A. S.; Shankar, J. (Bhabha Atomic Research Centre, Bombay). Indian J. Chem.; 8: 426-30(May 1970).

^{60}Co γ-induced solid state radiolysis of cobalt hexaammine nitrate was investigated both in the pure form and in KCl, KBr, or KI matrix. In the pure complex $G(NO_3^-) = 0.06$ and $G(Co^{2+}) = 2.10$. On doping, the former was enhanced whereas the latter decreases. The % decomposition was found to be linear up to a dose ~35 Mrads in all the cases. At 300°K in admixtures containing 1% complex + 99% KBr, % decomposition of NO_3^- in powder and pellet forms respectively was 70 and 140 times higher than that in the pure form. Irradiations at 77°K yielded still higher values. Under identical conditions, efficiency of the matrix for sensitization followed the order KCl < KBr < KI. $G(NO_3^-)$ obtained at 300°K for varying concentrations of KBr gave a maximum G = 0.7 for an admixture of 1:1 composition. On extrapolation to 100% KBr, the plot yields G(sensitizer) = 1.75. This was postulated as $G(\bar{e})$ untrapped. Also at a constant dose, the rate of nitrite formation versus $(KBr)^{\frac{1}{2}}$ yields a linear relationship indicating hole-electron localization on nitrate anion. No discernible energy transfer to cobalt hexaammine cation was observed by the techniques employed in this work. (auth)

169 OXYBROMINE RADICALS. Amichai, O.; Treinin, A. (Hebrew Univ., Jerusalem). J. Phys. Chem.; 74: 3670-4(1 Oct 1970).

The pulse radiolysis of BrO_3^- in water and its photolysis in boric acid glass were investigated. Both techniques give rise to three intermediates with λ_{max} at ca. 315, 350, and 475 nm. They were identified as BrO_3, BrO, and BrO_2, respectively. BrO results from the decomposition of BrO_3; this reaction appears to proceed by different mechanisms in water and in the rigid matrix. (auth)

170 EFFECT OF PHASE ON THE RADIOLYSIS OF SOLID ISOBUTANE AS STUDIED BY ELECTRON SPIN RESONANCE SPECTROSCOPY AND PRODUCT ANALYSIS. Wakayama, Terunobu; Miyazaki, Tetsuo; Fueki, Kenji; Kuri, Zen-ichiro (Nagoya Univ., Japan). J. Phys. Chem.; 74: 3584-9(1 Oct 1970).

The effect of phase on the radiolysis of solid isobutane at 77°K was studied by ESR spectroscopy and product analysis. Though only the isobutyl radical is formed in the polycrystalline state by γ irradiation of pure isobutane or of isobutane containing a small amount of 3-methylpentane or methylcyclohexane (MCH), the tertiary butyl radical is mainly formed in the glassy state. Since the isobutyl radical does not isomerize to the tert-butyl radical on standing at 77°K for 40 hr in an $i\text{-}C_4H_{10}$–MCH (4 mole/100 mole of $i\text{-}C_4H_{10}$) matrix and it does not isomerize by warming the γ-irradiated sample above 77°K, it was concluded that the tert-butyl radical is formed in the glass as a primary product and not through thermal isomerization at 77°K. The phase effect was not observed on decomposition of the excited isobutyl radical formed by illumination of the isobutyl radical with uv light at 77°K. The phase effect on the formation of butyl radicals is discussed from the viewpoints of cage effect and/or efficiency of energy transfer. It was also found that the yields of CH_4 and C_3H_8 in the radiolysis of solid isobutane at 77°K are much higher in the polycrystalline state than in the glassy state. (auth)

171 MULTIPLE PULSE RADIOLYSIS STUDIES OF INORGANIC MOLECULES WITH LOW ENERGY ELECTRONS. Dyson, K. O. (Cambridge Univ., Eng.). pp 23-35 of Dynamic Mass Spectrometry. Vol. 1. /Price, D. (ed.). Salford, Eng.; Heyden and Sons Ltd. (1969).

From 2nd European Symposium on the Time-of-Flight Mass Spectrometer, Salford, England. See CONF-690723.

An uncomplicated account of the reactions in an ion source is presented and a method discussed for observing the neutral products resulting from ionizing radiation without making major modifications to the physical layout of a mass spectrometer. A multiple pulse technique was developed permitting an initial electron radiolysis pulse to be followed sequentially by ion clearance and ionizing analysis pulses. An experiment using the technique is described and the results are given. Pulsed electron energy experiments, in which a single electron beam had its energy parameter pulsed from a pre-set bias level to a different, or a number of different, energy values in succession, are described. (UK)

172 HIGH-TEMPERATURE RADIOLYSIS OF m-TERPHENYL AND ITS HYDROGENATED DERIVATIVES. Lavrovskii, K. P.; Protsidim, P. S.; Titov, V. B. (Inst. of Petrochemical Synthesis, Moscow). Dokl. Akad. Nauk SSSR; 191: 1066-9 (11 Apr 1970). (In Russian).

Terphenyl and its derivates may be used in nuclear reactors as coolants and moderators. Samples were irradiated in evacuated ampules at 370°C in a nuclear reactor. The following G yields were determined. For m-terphenyl the G yields were 0.23 for products of destruction, 0.23 for the polymeric fraction (C > 18), and 0.001 for total gas. The hydrogenated m-terphenyl with 30% absorbed hydrogen gave G yields of 0.83 for products of destruction, 0.65 for the polymeric fraction, and 0.03 for total gas. The hydrogenated m-terphenyl with 60% absorbed hydrogen gave G yields of 1.37 for products of destruction, 0.85 for the polymeric fraction, and 0.06 for total gas. The hydrogenated m-terphenyl with 100% absorbed hydrogen gave G yields of 3.26 for products of destruction, 2.04 for the polymeric fraction, and 0.21 for the total gas. From these data it can be seen that m-terphenyl was the most stable and radioresistant of these compounds. (TTT)

173 MECHANISM OF LOW-TEMPERATURE RADIOLYSIS OF CRYSTALLINE ICE. Pikaev, A. K.; Ershov, B. G.; Puntezhis, S. A. (Inst. of Physical Chemistry, Moscow). Radiat. Eff.; 5: 265-8(Oct 1970).

The free radicals from γ radiolysis of crystalline ice with additions of alcohols and alkali hydroxides at 77°K have been studied by EPR and optical spectroscopy methods. It has been found that trapped electrons are formed in these systems. In the case of alcohol additions it has been shown by optical spectroscopy that the electrons are stabilized in traps consisting of molecules of impurities. The yield of radicals is increased with the growth of concentration of additions and is dependent on sample structure. The mechanism of radiation chemical processes in crystalline ice is discussed. (auth)

174 COMPOSITION OF PRODUCTS OF ISOOCTANE γ-RADIOLYSIS. Pichuzhkin, V. I.; Muratbekov, M. B.; Saraeva, V. V. Vestn. Mosk. Univ., Ser. II. Khim.; 11: 309-13(May-Jun 1970). (In Russian).

The effects of temperatures of −78 to −90°C and oxygen on the γ radiolysis of isooctane (indexed as 2, 2, 4-trimethylpentane) were studied. Data are given on the radio-chemical yield of hydrocarbon products during the radiolysis of isooctane in the presence and absence of oxygen at different temperatures. (R.V.J.)

175 PULSE RADIOLYSIS STUDIES. XIX. SOLVENT EFFECTS IN ELECTRON TRANSFER AND PROTON TRANSFER REACTIONS OF AROMATIC MOLECULE IONS. Brandon, J. R.; Dorfman, Leon M. (Ohio State Univ., Columbus). J. Chem. Phys.; 53: 3849-56(15 Nov 1970).

Absolute rate constants were determined, by the pulse radiolysis technique, for the electron transfer reaction from an aromatic radical anion to a different neutral aromatic molecule, $A_1\cdot^- + A_2 = A_1 + A_2\cdot^-$, for a number of aromatic molecule pairs in ethanol, in ethylenediamine, and in diethylamine. The dependence of these rate constants upon the standard free energy for reaction of the pair and on the dielectric properties of the solvent, as predicted by the theory of Marcus for electron transfer reactions, support this theory, at least semiquantitatively, over a limited range. The effect of solvent on the rate of protonation of the biphenyl radical anion by an alcohol, $C_{12}H_{10}\cdot^- + ROH = C_{12}H_{11}\cdot + RO^-$, was studied for a number of mixed solvent systems, namely, ethanol–ethylenediamine, ethanol–cyclohexane, ethanol–triethylamine, ethanol–diethylamine, ethylene glycol–ethylenediamine, and ethylene glycol–triethylamine. In the alcohol–amine systems the first order rate constant for the protonation reaction was drastically reduced in amine-rich solution and increased in alcohol-rich solution. The rate constant was increased at all concentrations of cyclohexane in the ethanol–cyclohexane system. These effects of the presence of a second solvent were attributed to the formation of a hydrogen-bonded complex between the amine and the alcohol, which reduces the rate in these systems, and to the solvent structure breaking effect of the cyclohexane, which increases the rate. (auth)

176 FREE RADICALS IN IRRADIATED IMIDAZOLES. Blum, Haywood; McGhie, A. R.; Kawada, A.; Labes, M. M. (Drexel Univ., Philadelphia). J. Chem. Phys.; 53: 4097-8 (15 Nov 1970).

ESR spectra were measured for single crystals of imidazole x irradiated at room temperature and studies were also made of benzimidazole, 2-methylbenzimidazole, and 2-mechylimidazole. (M.C.G.)

177 ACTIONS CHIMIQUES ET BIOLOGIQUES DES RADIATIONS. (The Chemical and Biological Actions of Radiations). Haissinsky, M. Quatorzieme Serie. Paris; Masson et Cie, Editeurs (1970). 240p. 110 F.

Three of the four chapters have been abstracted and indexed individually for NSA. The remaining chapter is a review of research on excess electron states in liquids. (J.G.B.)

For abstracts of individual chapters see: 154, 178, and 179.

178 RADIOLYSIS OF ALCOHOLS. Freeman, Gordon R. (Univ. of Alberta, Edmonton). pp 73-134 of Actions Chimiques

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et Biologiques des Radiations. /Haissinsky, M. Paris; Masson et Cie, Editeurs (1970).

The radiolysis of alcohols, in the liquid, solid, and vapor phases, is reviewed. Considerable attention is given to the mechanism and product yields from the radiolysis of methanol, ethanol, 1-propanol, and 2-propanol. (249 references) (J.G.B.)

179 SPATIAL DISTRIBUTION OF FREE RADICALS IN IRRADIATED SOLIDS. Ershov, B. G. (Inst. of Physical Chemistry, Moscow). pp 191-226 of Actions Chimiques et Biologiques des Radiations. /Haissinsky, M. Paris; Masson et Cie, Editeurs (1970).

Methods of investigation and their results are reviewed. Topics discussed are: radiospectroscopic methods for the investigation of spatial distribution of free radicals; spatial distribution of free radicals in frozen aqueous solutions, organic nonpolymeric compounds, and polymers; evaluation of the spur radius from data on the spatial distribution of radicals in solids; and, radical pairs. (71 references) (J.G.B.)

Radioisotope Production

Refer also to abstracts 202, 211, and 1741.

180 (AEC-tr-7027/7-8) NUKLEONIKA. Translation of Nukleonika; 14: 679-884(1969). 190p. (TT-69-50012/7-8). Dep. NTIS.

181 (KFK-1257) USE OF CHEMICAL REACTIONS OF RECOIL ATOMS FOR RADIONUCLIDE SEPARATION. I. CONTINUOUS CARRIER-FREE SEPARATION FROM FUSED OXIDES. Wolf, G. K.; Fritsch, T. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie). Aug 1970. 33p. (In German). Dep. NTIS (U. S. Sales Only).

Chemical reactions of atoms recoiling from nuclear reactions into a molten carrier to form volatile products offer possible separation principles. Irradiated suspensions of GeO_2 and SnO_2 in molten B_2O_3 and of WO_3 in molten $K_2Cr_2O_7$ were studied with respect to the volatilization of arsenic, antimony, indium, and osmium. The selectivity, efficiency, and speed of the separations were examined and the thermal and radiation decomposition of the targets measured. In all cases a more or less efficient volatilization was possible. The selectivity was good for the cases of arsenic and osmium. The hold up time of the products in the targets was 1 to 3 minutes for antimony, indium, and osmium and 30 minutes for arsenic. The general principles important for such reactions are discussed. As test for the $B_2O_3-GeO_2$ target, the half-lives of ^{69}AS and ^{69}As were determined. The resulting values were 19 ± 3 minutes and 7.5 ± 1 minutes. (auth)

182 RADIOCHEMICAL SEPARATION OF SILVER ISOTOPES. Keim, Rudolf (Max-Planck-Gesellschaft, Frankfurt am Main). Chem. Ztg.; 94: 559-60(1970). (In German).

Production and purification of radioactive silver isotopes are discussed. The methods considered include: adsorptive precipitation, isotopic exchange, ion exchange, and redox amalgam exchange. (M.C.G.)

183 NEW TARGET MATERIAL FOR THE PRODUCTION OF ^{131}I. Shikata, Eiji (Japan Atomic Energy Research Inst., Tokai). J. Nucl. Sci. Technol. (Tokyo); 7: 481-3(Sep 1970).

High-grade TeO_3 was prepared for use as neutron target material for the production of ^{131}I by dehydrating reagent-grade telluric acid, H_6TeO_6, at 300°C. After the TeO_3 was irradiated for 240 hr with a neutron flux of $\sim 10^{13} n/cm^2/sec$, the ~2mCi of ^{131}I was separated by a dry distillation technique. Heating under vacuum did not promote the distillation of ^{131}I, indicating that the ^{131}I is released during the crystal transformation accompanying the pyrolysis of TeO_3. (B.L.M.)

184 SEPARATION OF CARRIER-FREE ^{89}Zr FROM YTTRIUM TARGET. Inarida, Mariko; Shimamura, Akira (Inst. of Physical and Chemical Research, Yamoto, Japan). Rikagaku Kenkyusho Hokoku; 46: No. 3, 63-5(May 1970). (In Japanese).

Separation of carrier-free ^{89}Zr from the yttrium oxide bombarded by 15-MeV deuteron particles from the 160-cm IPCR cyclotron was studied. The bombarded yttrium oxide was dissolved in 10 M HCl and 2% TOPO–xylene was added to the resulting solution. The two phases were mixed well by shaking in a separatory funnel for one min. The carrier-free ^{89}Zr was separated by extraction with 2% TOPO–xylene and then it was back-extracted with 5% oxalic acid. The recovery efficiency was about 93%. A carrier-free ^{89}Zr with sufficiently high radiochemical purity was obtained by this simple procedure. (auth)

185 PRODUCTION OF CARRIER FREE ^{33}P BY PHOTONUCLEAR REACTION OF CHLORINE. Iwata, Shiro (Kyoto Univ.); Sasajima, Kazuhisa; Ohno, Shigeru. Nippon Genshiryoku Gakkaishi; 12: 504-8(Sep 1970). (In Japanese).

Phosphorus-33 is a useful radioisotope for biological and medical research, for its long half-life (25.4 day) and low β energy (0.25 MeV) compared with ^{32}P (14.3 day, 1.70 MeV). Two methods of production of this radioisotope in the carrier-free state have been already reported. $^{33}S(n,p)$ reaction with reactor neutrons and $^{34}S(\gamma,p)$ reaction with γ rays from electron linear accelerator. These methods, however, use natural targets, and the resulting $^{33}P/^{32}P$ ratio is low. The present report describes a method for producing high ratio $^{33}P/^{32}P$ by $^{37}Cl(\gamma,\alpha)$ reaction with γ rays from an electron linear accelerator giving a maximum energy of 18 MeV. NaCl and NH_4Cl are used as target materials. The $^{33}P/^{32}P$ ratio of the phosphorus fraction after chemical separation with cation and anion exchange columns is about 12/1 at the end of irradiation when using NaCl as target. (auth)

186 ^{252}Cf: ITS USE AND MARKET POTENTIAL. Aiken, S. C.; United States Atomic Energy Commission (1970). 28p.

The characteristics of ^{252}Cf are summarized and the AEC's market evaluation program presented. Topics covered include: characteristics, availability, uses, production, properties, test sources, and development of applications. (45 references) (M.C.G.)

Recoil Production and Reactions

Refer also to abstract 195.

187 (COO-1617-24) REACTIONS OF IODINE ACTIVATED BY THE NEUTRON CAPTURE PROCESS IN LIQUID AND SOLID ALKANES AND ALKENES. Ayres, Robert Leroy (Nebraska Univ., Lincoln. Dept. of Chemistry). 1970. Contract AT(11-1)-1617. 231p. Dep. CFSTI.

Thesis.

The influence of exchange and other experimental parameters on the radiative neutron-capture-induced organic yields of iodine in "pure" alkyl iodides was investigated. The $^{127}I(n,\gamma)^{128}I$ yields of organically bound iodine exhibited, to varying degrees, a dependence on exchange reactions, accompanying γ radiolysis, and phase. The kinetics of the addition of iodine to some alkenes were studied using ^{131}I-labeled iodine. Then the radiative neutron-capture-induced yields of iodine and the resultant product distributions were determined in n-pentane, 1-pentene, and cis- and trans-2-pentenes as functions of additive concentration and irradiation time. The organic yields of iodine from the $^{127}I(n,\gamma)^{128}I$ reactions in polycrystalline n-hexane were studied as a function of I_2 concentration. (M.C.G.)

188 (COO-1712-16) REACTIONS OF RECOILING SILICON ATOMS WITH PHOSPHINE SILANE AND DISILANE. Gaspar, Peter P.; Markusch, Peter (Washington Univ., St. Louis, Mo. Dept. of Chemistry). [1970]. 5p. Dep. NTIS.

Studies were made on the intermediacy of: $^{31}SiH_2$ and the occurrence of a novel reaction— the insertion of: $^{31}SiH_2$ into Si–Si bonds in fast-neutron irradiated phosphine–silane mixtures. The results showed that the small amount of $H_3{}^{31}SiSiH_3$ and the large amount of $^{31}SiSi_2H_8$ formed from the reactions of recoiling silicon atoms in phosphine–disilane mixture were in accord with the intermediacy of: $^{31}SiH_2$ which inserts into the Si–H (or Si–Si, vide infra) bonds of disilane to form the major product. The formation of small amounts of $H_3{}^{31}SiSiH_3$ and $^{31}SiH_4$ from a phosphine–disilane mixture suggests a mechanism for the formation of these products, and for the formation of $^{31}SiH_4$ from phosphine–silane mixtures, consistent with a dominant role for: $^{31}SiH_2$ as reaction intermediate. A remarkably high ratio of $^{31}SiSi_2H_8$ to $H_3{}^{31}SiSiH_3$ was obtained from phosphine–silane–disilane mixtures. (P.C.H.)

189 MEASUREMENT OF CHROMATE RETENTION BY LEAD CHROMATE PRECIPITATION. Ackerhalt, R. E.; Collins, C. H.; Collins, K. E. (State Univ. of New York, Buffalo). Radiochim. Acta; 14: 49-52(1970).

The effects of pH, both at the moment of precipitation of $PbCrO_4$ and the pH history preceeding precipitation, on the separation of Cr(III) and Cr(IV) by the conventional $PbCrO_4$ precipitation method was investigated in connection with studies on retention of ^{51}Cr in neutron-irradiated chromates. The method was found to be reliable only if very careful control and reproducibility of pH were exercised. The retention of ^{51}Cr in samples of partially annealed neutron-irradiated K_2CrO_4 was determined by the modified precipitation method, and the results are compared with those from an ion exchange method and found to be the same within experimental error. (B.L.M.)

XUM

190 INTERCOMPARISON OF THE HOT-ATOM EFFECTS AMONG α, β, γ, AND δ CRYSTALS OF COPPER PHTHALOCYANINE. Yang, Mo-hsiung; Kudo, Hiroshi; Yoshihara, Kenji (Japan Atomic Energy Research Inst., Tokai). Radiochim. Acta; 14: 52-3(1970).

The retention of ^{64}Cu recoil atoms was measured for the various crystal forms of copper phthalocyanine, and large differences were noted between the stable crystal form (β) and the metastable forms (α, γ, and δ). The retention due to isothermal annealing reactions proceeded in two stages, one below 200°C and the other above 250°C. The retention due to the initial recoil reaction is expressed in the order $\beta \gg \alpha \approx \gamma > \delta$, and the annealing reaction rate showed a similar tendency. (B.L.M.)

191 STUDY OF THE RELATIONSHIP BETWEEN THE BEHAVIOR OF RECOIL ATOMS AND CRYSTAL MORPHOLOGY. Yang, Mo-hsiung; Yoshihara, Kenji; Shibata, Nagao (Japan Atomic Energy Research Inst., Tokai). Radiochim. Acta; 14: 16-19(1970).

The effects of bulk properties of the crystals on the behavior of recoil atoms produced in copper phthalocyanine were studied. The effects of crystal size on the initial retention and the annealing reaction of Stage I were only slight, whereas the effects on Stage II were very prominent. The crystals of smaller size, which have a higher defect density in the crystal lattice, were found to anneal much more easily in Stage II, but no such prominent effect could be observed in the initial retention nor in the annealing reaction of State I. Stage I is considered to be a short-range process whereas Stage II is a long-range process. (auth)

192 RADIATION CHEMISTRY OF ^{128}I PRODUCED BY THE $^{127}I(n,\gamma)^{128}I$ PROCESS FROM ALKYL IODIDES IN HYDROCARBONS. 1. Vlatkovic, Milenko; Willard, John E. (Univ. of Wisconsin, Madison). Contract AT(11-1)-1715. Radiochim. Acta; 14: 19-22(1970).

The results of tests of the effects of reactor γ dose and dose rate on the chemical yields of ^{128}I from the $^{127}I(n,\gamma)^{128}I$ process in solutions of an alkyl halide in a hydrocarbon are reported. These lead to the conclusion that $I^{128}I$ and $H^{128}I$ resulting from the nuclear reaction become part of a steady state pool of inorganic iodine, which is generated and maintained at low concentration by the γ radiation accompanying the neutron irradiation. At high doses the removal of iodine from this pool by free radicals to form organic iodides accounts for a heretofore unexplained rise in organic yield at high doses. The effect of reactor dose on the organic yield of ^{128}I was tested on three concentrations of $n\text{-}C_4H_9I$ in liquid 3-methylpentane (3MP). It was also tested in solid 3MP and in methyl tetrahydrofuran. The yields of $n\text{-}C_4H_9{}^{128}I$ relative to other $R^{128}I$ were determined in 3MP. (auth)

193 ESTRUP-WOLFGANG THEORY OF HOT REACTIONS. Urch, D. S. (Democritus Nuclear Research Centre, Athens). Radiochim. Acta; 14: 10-16(1970).

The application of the Estrup–Wolfgang kinetic theory to the results of "hot-atom" experiments is considered critically for a variety of situations. It was found that the functions used in the analysis tend to give straight line relationships even when all the conditions, thought necessary for the theory to be valid, have not been met. It was concluded that the observation of straight lines in Estrup–Wolfgang graphs does not permit any conclusions to be drawn concerning the fundamental chemical processes in hot-atom reactions. (auth)

194 MOESSBAUER-EFFECT STUDY OF THE AFTEREFFECTS OF NUCLEAR TRANSFORMATIONS IN SOLIDS. Murin, A. N.; Bondarevskii, S. I.; Seregin, P. P. (Leningrad State Univ.). Sov. Phys.-Solid State (Engl. Transl.); 12: 857-9 (Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1095-8(Apr 1970).

The aftereffects of the (n, γ) reaction in tin monoxide irradiated in a reactor have been studied by the Moessbauer method. The experimental results have been used in a discussion on the mechanisms for the stabilization of recoil atoms in a solid. The retention of a large number of recoil atoms at lattice sites during nuclear reactions characterized by high recoil energies has been confirmed by the Moessbauer method. This is explained by a disruption of the correlation between the recoil momentum and the recoil energy. (auth)

Radiochemistry

Refer also to abstracts 64 and 460.

195 (NP-18396) CHEMICAL CONSEQUENCES OF THE NUCLEAR TRANSFORMATIONS OF XENON IN AN AQUEOUS SOLUTION OF XENON TRIOXIDE. Cassou, Maurice (Strasbourg Univ. (France). Faculte des Sciences). 16 Mar 1970. 80p. (In French). Dep. CFSTI (U. S. Sales Only).

Thesis.

Aqueous solutions of Xe trioxide were irradiated in a thermal neutron flux of 10^{12}n $cm^{-2}s^{-1}$. The low retention value and the isotopic effect observed enable highly ^{125}Xe-enriched radioxenon to be obtained for short irradiation times. The chemical consequences of the $^{133m}Xe \rightarrow {}^{133}Xe$ transition in XeO_3 were also studied and the yield of Xe–O bond rupture was determined. The value found is equal to the transition yield by internal conversion. The experiment shows that radiochemically pure ^{133}Xe may be obtained from ^{133m}Xe-labeled XeO_3. (auth) (France)

196 γ- AND X-RAY SPECTRA OF ^{125}I AND ^{197}Hg USED AS THE ACTIVE INGREDIENT OF RADIOPHARMACEUTICALS. Hasegawa, Akira; Urakubo, Goro (National Inst. of Hygienic Sciences, Tokyo). Eisei Shikenjo Hokoku; No. 87, 68-9(Dec 1969). (In Japanese).

^{125}I and ^{197}Hg are used as the active ingredients of radiopharmaceuticals. For their identification by means of measuring the energy of the most prominent photon, γ- and x-ray spectra were measured with Ge(Li) detector. The spectra were shown in figures. (auth) (Japan)

Separation Processes

Refer also to abstracts 14, 19, 20, 28, 35, 55, 64, 76, 77, 181, 631, 682, 683, 736, and 1971.

197 (AECL-3684) HEAVY WATER PRODUCTION BY AMINE-HYDROGEN EXCHANGE. Bancroft, A. R.; Rae, H. K. (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Aug 1970. 12p. (CONF-700925-1). Dep. NTIS (U. S. Sales Only). AECL $0.50.

From Symposium on the Technical and Economic Aspects of Heavy Water Production, Turin, Italy.

Several amines have properties that make them more attractive than ammonia for enriching deuterium by exchange with hydrogen. These include lower vapor pressure and faster exchange rates, which contribute to a lower energy consumption and smaller capital investment. The cost of heavy water by amine-hydrogen exchange is expected to be 10 to 30 percent less than by established processes. For production rates up to about 100 Mg per year ammonia synthesis gas or other industrial hydrogen streams can be used as feed. Much larger plants can be fed with water by way of a steam-hydrogen exchange step. Laboratory and pilot-plant scale development began in 1968; the results show excellent prospects for this process. (auth)

198 (CEA-Bib-136) STABLE ISOTOPES. Vasaru, Gheorghe (Academia R. S. R., Cluj. Institutul de Fizica Atomica). Sep 1970. 373p. (In French). Dep. NTIS (U. S. Sales Only).

Translated by Alice Courtot (CEA, Saclay, France).

A French translation of a Rumanian bibliographic survey on stable isotopes up to 1966, dealing with separation and analytical methods and the various applications of stable isotopes is presented. (France)

199 (CEA-R-4075) METHOD FOR A LONG TERM ECONOMIC COMPARISON OF NONAQUEOUS AND AQUEOUS REPROCESSING AS A PART OF THE FUEL CYCLE OF BREEDER REACTORS. Thiriet, Lucien (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). Oct 1970. 48p. (In French). Dep. NTIS (U. S. Sales Only).

The recommended method consists of studying the optimum sizes and locations of fuel reprocessing plants for breeder reactor fuels within the scope of an increasing demand for nuclear power (large plants on suitable sites or smaller plants on the reactor sites). In fact, a compromise must be found between the economies resulting from a growth of plants and the economic losses due to an increase of transportation costs on one hand and a poor utilization factor of the plants, on the other. The specific advantages of the nonaqueous method can then be compared economically to the aqueous method for different nuclear power programs and the different European geographical regions considered. (France)

200 (CONF-700403-(Vol.1), pp 246-56) COMPARISON OF ELUTING AGENTS FOR ION-EXCHANGE PURIFICATION OF PROMETHIUM. Wheelwright, E. J. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Laboratory experiments have shown that NTA (nitrilotriacetic

acid) is markedly superior to EDTA (ethylenediaminetetraacetic acid) or DTPA (diethylenetriaminepentaacetic acid), the complexing agents previously used, for kilogram-scale ion-exchange purification of promethium. With NTA elution at 60°C, the position of yttrium is changed from the critical Sm–Pm–Nd zone (with DTPA the sequence is Sm–Y–Pm) to a place ahead of gadolinium; yielding an elution order: Y, Gd, Eu, Sm, Pm, Nd, Pr. As a result of faster kinetics in the NTA system, a 100% increase in the rate of band advance, compared to the rate obtained in the previously used DTPA process, can be achieved with equal or superior separation efficiency. The time required for a 300,000 Ci purification run has been reduced from 21 days with EDTA or 6 days with DTPA to less than 3 days with NTA. (auth)

201 (CONF-700403–(Vol.1), pp 293-304) ANALYSIS OF THE ELUTION SYSTEM OF RARE EARTHS WITH CHELATING AGENT AS ELUENT. Hagiwara, Zenzi (Tohoku Univ., Sendai (Japan)); Sakaguchi, Susumu (Shinetsu Chemical Co., Tokyo (Japan)).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Under steady-state conditions, elutions of the Tb–Y and Dy–Y pairs were performed at different temperatures using EDTA and involving a metal chelate. After the establishment of a steady state throughout the exchange system, several series of the experimental data on the rare earth eluates from the ion exchange column were analyzed on the basis of rate theory, employing the separation factors measured in similar conditions to those in the real elution system. It was found that the present ion-exchange system was controlled by film diffusion as the rate-determining step and the plate-height values due to film diffusion (Hf) were found to be a function of the flow rate. The Hf values were consistent with the HETP values obtained from the point of countercurrent extraction. Also, in an attempt to justify the observed α values needed to analyze the elution results of the rare earth mixtures at different temperatures, the separation factors of the Tb–Y and Y–Dy pairs in the presence of chelating agent were discussed. (auth)

202 (CONF-700403–(Vol.1), pp 448-59) ISOTOPIC ENRICHMENT OF THE PRODUCT OF A LANTHANIDE NEUTRON CAPTURE REACTION. Campbell, David O. (Oak Ridge National Lab., Tenn.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

A procedure is described which results in a substantial enrichment of the product isotope resulting from neutron capture by a lanthanide isotope. The lanthanide is loaded by ion exchange into a faujasite zeolite (Linde X or Y), given an appropriate heat treatment, irradiated in a nuclear reactor, and finally eluted with a concentrated salt solution. Typically, the eluate contains about 50% of the neutron capture product and less than 1% of the target isotope. The reaction was demonstrated with praseodymium, neodymium, erbium and thulium, as well as with zeolites containing two rare earths. (auth)

203 (CONF-700403–(Vol.2), pp 532-44) COMPARISON OF SUBLIMATION AND VAPORIZATION FOR PURIFICATION OF SAMARIUM METAL. Murphy, J. E.; Morrice, E.; Wong, M. M. (Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

Purification of samarium metal by sublimation and purification by vaporization from a low-melting metal flux are compared at the same temperature. Vaporization is more effective for removing impurities such as magnesium, calcium, and manganese. Recovery of samarium, however, is more rapid by sublimation because of its constant rate of distillation. (auth)

204 (CONF-700403–(Vol.2), pp 762-73) USE OF A MIXER-SETTLER TO UPGRADE A RARE EARTH MIXTURE FOR PROMETHIUM PURIFICATION. Partridge, J. A. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

A continuous flow counter-current mixer-settler process was used to up-grade a simulated rare earth mixture for promethium purification by ion exchange. With a small 21-stage mixer-settler, the mole percentage of promethium in the feed was increased by a factor of 3, with less than 5% promethium loss. The up-graded feed would make possible larger ion-exchange batch-sizes, thus reducing processing time. The use of the up-graded feed would also increase the life of the resin, since the amount of radioactive cerium is reduced by a factor of about 4.4. (auth)

205 (CONF-700403–(Vol.2), pp 788-801) SEPARATION OF NEODYMIUM, SAMARIUM, AND GADOLINIUM BY LIQUID–LIQUID CHROMATOGRAPHY. Winget, J. O.; Lindstrom, R. E. (Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

Neodymium, samarium, and gadolinium were separated by a liquid–liquid chromatographic technique. Sulfuric acid was more effective than hydrochloric or nitric acid as an eluant with di(2-ethylhexyl) phosphoric acid (EHPA) as the stationary phase. Recovery of 45% of the neodymium as >90% Nd_2O_3, 84% of the samarium as >99% Sm_2O_3, and 50% of the gadolinium as >99% Gd_2O_3 was achieved. The degree of separation and the time required for the separation can be varied by changing the concentration of the eluant and the number of stages in the system. A system comprising a primary amine organic extractant and an aqueous eluant containing diethylenetriaminepentaacetic acid (DTPA) was less effective for separating the rare earths. (auth)

206 (CONF-700403–(Vol.2), pp 802-13) USE OF ORGANOPHOSPHORUS COMPOUNDS IN SEPARATION OF THE RARE EARTHS. Long, Robert E. Jr.; Kim, Tai K. (Sylvania Electric Products, Inc., Towanda, Pa.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

The use of alkylphosphoric acids in combination with other organophosphorus compounds as extraction agents for the rare earths is discussed. Alkylphosphoric acids containing alkyl groups with from five to sixteen carbon atoms were examined. The organophosphorus compounds included phosphines, phosphine oxides, phosphonates and phosphates. Of particular interest is a system employing mono- and di- tridecyl phosphoric acid, tri-n-butyl phosphate and kerosene. This system was investigated with respect to the effect of the concentration of the components of the organic phase, the aqueous feed concentration and the pH of the aqueous feed and scrub solutions. Efficiency of rare earth separation, throughput capacity, and physical conditions are improved in comparison with other systems. (auth)

207 (CONF-700403–(Vol.2), pp 814-26) SEPARATION OF THE HEAVY LANTHANIDES FROM YTTRIUM. Gump, J. R. (Central Michigan Univ., Mount Pleasant. Dept. of Physics and Physical Sciences).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

Ytterbium may be separated from yttrium with considerable efficiency; whereas, the separation of thulium, erbium and holmium from yttrium is somewhat less efficient. This liquid-liquid method of separation uses mono-di-tridecyl orthophosphoric acid as the active ingredient in the organic phase, while the aqueous phase contains chelating agents in buffered systems. Separation factors have been calculated for the ions under a number of different experimental conditions with the separation factors of yttrium to ytterbium varying through a considerable range as the aqueous phase composition is altered. (auth)

208 (DOCKET-50201–50) WEST VALLEY REPROCESSING PLANT. Quarterly Report, July 1–September 30, 1970. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 2 Nov 1970. 13p. Dep. NTIS.

Processing of Yankee-Rowe and Pathfinder fuel was completed and preparations made for processing Big Rock Point fuel. Nuclear materials accountability records are summarized to indicate the disposition of nuclear material in fuel at the processing plant. ^{131}I concentrations in milk from the NFS farm were below 1×10^{-8} μCi/ml. Major malfunctions and modifications relative to safety that were either completed or initiated at the processing plant during the reporting period are described. (M.C.G.)

209 (DOCKET-50372–1) ATLANTIC RICHFIELD COMPANY REPROCESSING CENTER. Safety Analysis Report, Vol. 1. (Atlantic Richfield Co., New York). Oct 1970. 375p. Dep. NTIS.

A Safety Analysis Report is submitted in support of the application for a construction permit and facility license. The plant is designed to process irradiated fuels from light-water-cooled nuclear power plants with plant feed initially consisting of uranium oxide fuels clad in stainless steel or zirconium alloys. The plant design is based on a shear-leach head end, combined with a Purex-type solvent extraction system. Design criteria, site description, process systems, and confinement systems are discussed. (M.C.G.)

XUM

210 (DOCKET-50372-2) ATLANTIC RICHFIELD COMPANY REPROCESSING CENTER. Safety Analysis Report, Vol. 2. (Atlantic Richfield Co., New York). Oct 1970. 454p. Dep. NTIS.

For a safety analysis of the Atlantic Richfield Plant, auxiliary systems, the radiation protection system, preoperational testing, management systems, safety, and technical specifications are discussed. Appendixes are included on the following topics: nuclear properties of irradiated fuel, criticality prevention, site evaluation, meteorological and diffusion study, design criteria, engineering analyses, calculation of radionuclide releases and radiation doses, quality assurance, and environmental program. (M.C.G.)

211 (DP-1236) RECOVERY OF ^{147}Pm FROM SAVANNAH RIVER PLANT WASTE. Lowe, John T. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). Oct 1970. Contract AT(07-2)-1. 16p. Dep. NTIS.

Batch solvent extraction procedures were developed for recovering ^{147}Pm, as a mixture of fission product lanthanides, from aqueous wastes after processing irradiated nuclear fuels. Incidentally produced plutonium isotopes were also recovered. Extraction of the lanthanides with 50% tributyl phosphate (TBP) from concentrated $Al(NO_3)_3$ or $NaNO_3$ solutions was followed by back extraction into dilute nitric acid. ^{144}Ce was separated from the mixture by oxidation to Ce(IV) and extraction with 50% TBP. Approximately 3 kg of ^{147}Pm were recovered in two plant tests. (auth)

212 (DP-Report-424) REPROCESSING OF U/Th FUEL FOR HIGH TEMPERATURE GAS COOLED POWER REACTORS. Project DRAGON. Short, G. D.; Orsenigo, G.; Roemberg, E. (Atomic Energy Establishment, Winfrith (England)). May 1966. 46p. (CONF-660582-1). Dep. NTIS.

From Second International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.

In order to assess with a higher degree of confidence the generating costs of a HTR power plant, a conceptual design study for reprocessing of HTR fuel was initiated. For planning purposes the size of the program was put at 10,000 MW(th). For the purpose of costing reprocessing of spent fuel and refabrication it was decided that a central reprocessing/refabrication plant would be required. Some of the additional assumptions introduced were as follows: fuel, $(U-Th)C_{2.4}$, 93% enriched, PyC-SiC-PyC coated particles of approximate 500 μm diameter; burnup, 150,000 Mwd/t over four years; reloading, 25% of the core per year; ratio Th/U-235; 12; and ratio C/U-235: 3,000. On the basis of above specification the daily throughput of the reprocessing plant amounts to approximately 90 kg heavy metal and 1,000 kg carbon. Two routes are under investigation for the head-end treatment comprising grind-leach and grind-leach preceded by electrolytic compact disintegration. Decontamination and product separation are carried out in a modified Acid-Thorex process. The merits of minimum decontamination from co-extracted U/Th/Pu associated with remote refabrication are compared with high decontamination of separated uranium as required for direct refabrication of HTR fuel in lightly shielded equipment. Capital and direct operating costs are presented for the grind-leach head-end process and the solvent extraction separation system. (auth)

213 (EUR-4047(Pt.2)) DEVELOPMENT OF A METHOD OF CONCENTRATING AND DRYING LIQUID RADIOACTIVE WASTE AT LOW TEMPERATURES AND SMALL TEMPERATURE DIFFERENTIALS. Jessnitzer, K.; Lehmann, H. J. (Leybold-Heraeus G.m.b.H., Cologne (West Germany)). 8 Jan 1970. 62p. (In German). Dep. NTIS (U. S. Sales Only). EUR DM 6,20.

A process for the treatment of radioactive effluents by vaporization until a dry end product is obtained is being developed. In order to achieve good separation effects, the vaporization is carried out in vacuo and at temperatures below 100°C. The individual stages in the process are as follows: vaporization of the solution in a wetted-wall evaporator at vaporization temperatures of 20 to 50°C, freezing of the concentrate, and production of a granulate freeze drying. After an operational boiler had been developed by the end of the second year of the contract, a few selected freezing processes and the freeze-drying step were investigated and improved. This work also produced reliable freezing processes. The decontamination factor, i.e., the ratio of specific activity of the boiler concentrate to that of the condensate, was determined for the freeze drying step with the aid of radioactive tracers. (auth)

214 (INR-1165) ACTUAL STATUS OF RADIOACTIVE WASTE TREATMENT AT THE INSTITUTE OF NUCLEAR RESEARCH, POLAND. Tymochowicz, S.; Tomczak, W. (Institute of Nuclear Research, Warsaw (Poland)). 1970. 41p. Dep. CFSTI (U. S. Sales Only).

The problem of radioactive wastes emerged after the first water reactor was put into operation. Transport, processing, and storage of radioactive wastes and research on the treatment of radioactive wastes are discussed. For management of wastes, the precipitation of radionuclides with calcium phosphate and ferric hydroxide or copper ferrocyanide, concentration by evaporation processes, and incorporation in concrete of sludges and concentrates were used. The sorption of radioactive nuclides by inorganic materials and solidification of sludges and concentrates in bitumen is also applied. Solid wastes are stored in concrete cells and moats. (auth)

215 (K-L-6257) REMOVAL OF RADIOACTIVE KRYPTON AND XENON FROM CONTAMINATED OFF-GAS STREAMS. Merriman, J. R.; Stephenson, M. J.; Pashley, J. H.; Dunthorn, D. I. (Oak Ridge Gaseous Diffusion Plant, Tenn.). [1970]. 29p. (CONF-700816-4). Dep. NTIS.

From 11th AEC Air Cleaning Conference, Richland, Wash.

An absorption process for the removal and concentration of the noble gases from contaminated gas streams is evaluated. The separation process is based on the selective dissolution of krypton and xenon in a fluorocarbon solvent. A pilot plant capable of processing up to 20 scfm of gas was designed and built to establish process feasibility and to collect engineering data necessary for the design of plant-scale systems. During the first experimental phase of the project, a total of 34 pilot plant tests were conducted using refrigerant-12 as the process solvent. For the second phase, 40 tests were completed using refrigerant-11. Both sets of pilot plant experiments were conducted over wide ranges of operating conditions to define the process characteristics as completely as possible. Using an absorber column containing 9 feet of packing, column krypton decontamination factors as high as 1000 were measured, with 99.9% of the krypton in the contaminated feed removed. Stage height data were also measured and correlated using operating conditions to form parameter groupings. The design, construction, and operation of the plant are relatively straightforward; consequently, the process lends itself well to nuclear applications where a high degree of reliability is essential. (auth)

216 (MLM-1726) MOUND LABORATORY CHEMISTRY AND PHYSICS PROGRESS REPORT, JANUARY-MARCH 1970. (Mound Lab., Miamisburg, Ohio). 23 Oct 1970. Contract AT-(33-1)-Gen-53. 26p. Dep. NTIS.

The uranium-234 recovered by extraction from waste raffinate solutions was found to be grossly contaminated by natural uranium in the plutonium-238 recovery process. No further processing of this material at this low uranium-234 isotopic composition will be performed. Additional analytical data have been obtained to evaluate the new TOPOAPHA method of uranium-234 determination. The errors found for this method seem to be realistic, but could probably be reduced by further development work and by analyzing multiple samples. A new, semiautomatic apparatus for solvent extraction separation of thorium-229 from uranium-233 using dibutyl phenylphosphonate was assembled and tested. The principles of a method of determining bismuth-210, lead-210, and polonium-210 (RaD, E and F) in solution by liquid scintillation counting are presented. The method makes use of the three independent channels of pulse height analysis which are available. The possibility of determining niobium by 14-MeV neutron activation analysis was investigated. The reaction ^{93}Nb(n,2n)^{92m}Nb with a 500-mb cross section appears to be the best approach. In this analysis, the 10.2-day activity of ^{92m}Nb is detected by measuring its 0.934-MeV gamma radiation. A solvent extraction system was investigated along with spectrum stripping for the analysis of traces of mercury in copper by the standard additions method in connection with neutron activation. The possibility of counting the samples with a Ge(Li) detector, without any chemical separation, was also investigated. Poor precision was also attained recently when the standard spectrophotometric procedure was used for the analysis of iron in two plutonium nitrate samples. It was theorized that the o-phenanthroline complexing agent had been consumed by an impurity introduced by the sampling bottle's rubber septum. The procedure was modified to increase the quantity of complexing agent added, and more satisfactory results were obtained. Extremely low results, compared to the theoretical values, were obtained for selenium and tellurium when several rare earth selenides and tellurides were analyzed by atomic absorption using an argon-hydrogen flame. Use of the higher temperature acetylene-air flame eliminated the interference by the rare earths and other metal cations investigated. The overall relative standard deviation for the determination of nitrogen in the 0.1 to 0.8% range by 14-MeV neutron activation is approximately ±10%. A multiple summation and spectrum smoothing are being investigated for increasing the precision. A mass selector circuit was installed on an Atlas CH-4B mass spectrometer in

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order to decrease the time required for routine analysis of gaseous samples. An option allows the original mass selector circuit to be used for analyses not available on the selector switch. A scan reverse switch makes it possible to reverse the scan at any point. (J.G.B.)

217 (NP–18397) REPROCESSING CAMPAIGNS FOR HIGHLY ENRICHED URANIUM DURING 1967 AND 1968 AT EUROCHEMIC. Joseph, C. J.; Van Geel, J.; Cao, S. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). Sep 1969. 57p. (ETR–238). Dep. CFSTI (U. S. Sales Only).

The results and experience obtained with the two reprocessing campaigns for highly enriched uranium during 1967 and 1968 at Eurochemic are described. A total of 164 kg highly enriched uranium (HEU) was treated in 1967 from fuels originating from different reactors, as ASTRA, DIDO, R-2, HFR, BR-2, SILOE, TRITON, CABRI, PEGASE, and OSIRIS. A total of 95 kg HEU was treated in 1968 from fuels originating from the same reactors. The measured overall uranium losses were about 0.5% including the losses during plant rinsing after each HEU campaign. Some 200 kg of recovered uranium (UNH) have been transformed into UF_6 by a European subcontractor and shipped back to the United States. The UF_6 product was within the USAEC specifications. Waste volumes were 500 and 250 l/kg HEU, respectively, processed as High Level Waste and concentrated hot waste stored as Medium Level Waste. (auth)

218 (NP–18398) DISTRIBUTION OF U(IV) AND U(VI) BETWEEN TRIBUTYL PHOSPHATE AND NITRIC ACID AND THEIR SEPARATION BY EXTRACTION CHROMATOGRAPHY. Eschrich, H. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). May 1969. 45p. (ETR–249). Dep. CFSTI (U. S. Sales Only).

The distribution of tetravalent and hexavalent uranium between undiluted tributyl phosphate and 0.2 to 14 M aqueous nitric acid phases has been determined by means of batch extractions, column elution, and break-through experiments. The separation factor [U(VI)/U(IV)] in the extraction system TBP–H_2O–HNO_3 for aqueous equilibrium nitric acid concentrations between 0.5 and 4.5 M was found to be 3.75 ± 0.15; at aqueous nitric acid concentrations higher than 4.5 M the separation factor was lower reaching a minimum value of 1.30 at 9.5 M. Extraction chromatographic separations of Pu(III), U(IV), and U(VI) were successfully performed using undiluted (100%) tributyl phosphate sorbed on polytrifluoromonochloroethylene particles (Voltalef 300LD) as stationary phase and 0.7 to 5.0 M nitric acid/0.1 M hydrazine as mobile phase (eluting agent). All essential experimental data and results are summarized in tables and the elution behavior of Pu(III), U(IV), and U(VI) is illustrated by graphs. (auth)

219 (NP–18399) DISTRIBUTION OF NITRIC ACID BETWEEN WATER AND 100 PERCENT TRI-n-BUTYL PHOSPHATE AT VARIOUS TEMPERATURES. Eschrich, H. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). Jan 1970. 25p. (ETR–255). Dep. CFSTI (U. S. Sales Only).

The distribution of 0 to 14 M nitric acid between aqueous and 100 vol % tributyl phosphate (TBP) phases at 4, 25, 37, and 75°C has been measured. It was found that temperature has a strong effect on the partition of nitric acid up to an equilibrium aqueous nitric acid concentration of 1.5 M; beyond this concentration the distribution of nitric acid between water and undiluted TBP is only slightly influenced by temperature variations. The distribution coefficient of nitric acid decreased with an increase in temperature at equilibrium aqueous acidities up to 2 M whereas at higher acidities the distribution coefficient increased with temperature. (28 references). (auth)

220 (NP–18479) PRIMARY AMINE EXTRACTION OF THE RARE-EARTH ELEMENTS FROM AQUEOUS ORGANIC ACID SOLUTIONS. Kuiper, Dirk (Vrije Universiteit, Amsterdam (Netherlands)). 1969. 110p. Dep. NTIS (U. S. Sales Only).

Thesis.

The satisfying extraction of rare earths with a wide variety of organic acids, such as mono-, di-, and tricarboxylic acids and hydroxy acids and also with aminopolycarboxylic acids is discussed. This can only be obtained using primary amines such as Primene JM–T or tri-(isopentylmethyl) amine, TIPMA. When secondary or tertiary amines are used the rare earth elements are not extractable. Other metals can also be extracted using the above mentioned primary amines. The extractions depend significantly on the buffer composition, the buffer concentration, the amine concentration, and the organic solvent. A great variety of extraction experiments with malonic and tartaric acid as organic acid and Primene JM-T and TIPMA as amine are described. The concentration and composition of the buffer solution was varied in these experiments. It was concluded that the acid H_2L is extracted by the amine A as $(AH)_2L$ at low acid concentrations, whereas at high acidities (AH)HL can be formed, depending on the acid used. When only $(AH)_2L$ is formed, the conditions are favorable for the rare earth extraction. In addition, it was concluded from equilibrium calculations that the salt $(AH)_2L$ is present as dimers or trimers at the concentrations used (about 0.01 M). Titrations and conductivity measurements of the equilibrated aqueous phase and equilibrium calculations indicate that the small fraction of the amine which is dissolved in the aqueous phase is present as free AH^+-ions. Further work on the acid extraction is also described. It appears that at high $(AH)_2L$-concentrations in the organic phase the number of water molecules bound per$(AH)_2L$-molecule increases with increasing $(AH)_2L$-concentrations. The viscosity of these organic solutions increases with the water content. Infrared spectra showed clearly that the salts $(AH)_2L$ are purely ionic; H-bridges are present in addition. Possible structures of the $(AH)_2L$-salts are discussed. The association of these salts is discussed in terms of dipole–dipole interactions, intermolecular bridge formation by AH^+-ions, and micel formation. Electrophoresis experiments showed that under the conditions used only negatively charged complexes are present in the aqueous phase. A stronger complex formation in the aqueous phase promotes the extraction. It was concluded from equilibrium relations, chemical analysis of the extracted complex, and from loading experiments that the extracted complex is $(AH)_3ML_4$. This composition implies the existence of the complex ML_4^{3-}. Possible structures are discussed. The difference between primary, secondary, and tertiary amines was studied by means of extraction experiments and infrared spectra of the $(AH)_2L$-salts. The great differences in extraction behavior can easily be explained as a result of a different structure of the AH^+-L^{2-}-bond. The addition of mineral salts, such as NaCl and $NaNO_3$, suppresses the extraction significantly. However, this effect may be useful for some practical purposes, as is discussed. The results of the extraction experiments with nitrilotriacetic acid, NTA, seem to indicate a rather complicated system. However, it appears that the NTA-system behaves principally similar to the malonic and tartaric acid systems. (122 references) (auth)

221 (UCRL–19526) ELECTROCHROMATOGRAPHIC SEPARATIONS OF RARE EARTHS. Nady, Louie; Vermeulen, Theodore R. (California Univ., Berkeley. Lawrence Radiation Lab.). May 1970. Contract W-7405-eng-48. 171p. Dep. NTIS.

Thesis. Submitted by Louie Nady.

Electrochromatography was investigated as a possible separation process for ions, particularly for lanthanides and actinides. Following a review of previous work, two new advances were developed. One is a proposed device in which a stable broad-band concentration gradient is developed by applying a d-c voltage to a packed bed of ion-exchange resin confined by ion-exchange membranes. The resulting separation depends on solution-phase and resin-phase mobilities of the ions and on the resin selectivity for the ions. Because resin-phase mobilities play an important part, bed conductivity measurements were made for Dowex 50W-X4 resin in equilibrium with solutions of NaCl, $AgNO_3$, $La(NO_3)_3$, $Ce(NO_3)_3$, $Nd(NO_3)_3$, $Ho(NO_3)_3$, and mixtures of $AgNO_3$–$La(NO_3)_3$, and $AgNO_3$–$Ce(NO_3)_3$. Particle conductivities were then calculated by use of Bruggeman's equation. Electrolyte sorption for these same ions into Dowex 50W-X4, and of $La(ClO_4)_3$ into Dowex 50W-X2, X4, X8, and X12 was investigated. The resulting identification of all species in the resin phase made it possible to determine resin-phase mobilities for the individual ions. The second advance is the development and operation of a continuous preparative-scale ligand electrochromatograph. Continuous separation is achieved in this unit as a result of transverse electrophoretic migration of uncomplexed rare earth ions across a laminar flow of complexing agent in a packed bed. Selective complex formation with the ion mixture (with a resultant marked mobility change for the complexed species) causes the net electrophoretic migration rates to differ for each component, hence separates them. Zones of relatively pure Ce^{3+} and La^{3+}, in different runs, were achieved from mixtures of the two ions, using EDTA as the ligand. (auth)

222 (WASH–1152) AEC CONCEPTUAL HIGH-TEMPERATURE GAS-COOLED REACTOR (HTGR) FUEL PROCESSING PLANT. (Idaho Nuclear Corp., Idaho Falls). Oct 1970. 71p. Dep. NTIS.

The technical background and economic and process parameters used to develop a single purpose conceptual plant for processing irradiated High-Temperature Gas-Cooled Reactor (HTGR) fuel are described. Information on the plant design criteria, plant capital cost, operating cost estimate, etc, is also provided. (auth)

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223 FORMATION CONSTANTS AND SOLVENT EXTRACTION OF LANTHANIDE COMPLEXES OF 1,1,1,2,2,3,3-HEPTAFLUORO-7,7-DIMETHYL-4,6-OCTANEDIONE. Sweet, Thomas R.; Brengartner, Dennis (Ohio State Univ., Columbus). Anal. Chim. Acta; 52: 173-81(Nov 1970).

A solution of 0.10 M 1,1,1,2,2,3,3-heptafluoro-7,7-dimethyl-4,6-octanedione in carbon tetrachloride was used to study the extraction of praseodymium, samarium, europium, gadolinium, and terbium by a back-extraction technique. The pK_a and the distribution of the reagent between the organic phase and the aqueous phase, 0.10 M $(C_2H_5)_4NClO_4$, were determined. This β-diketone extracted all the lanthanides studied essentially 100% in the pH range of 5.5 to 8.5. The distribution data can be explained by the presence of $(Mfod)_3$ (fod = reagent anion) in the organic phase, and M^{3+}, $M(fod)_2^+$, $M(fod)_3$ and $M(fod)_3OH^-$ in the aqueous phase. The overall stability constants for the aqueous species were determined. The distribution coefficients for the neutral chelates, the $K_{D,MR_3} \cdot \beta_{30}$ values, the overall extraction constants, and the separation factors were also obtained. (auth)

224 NATURAL WATER DISTILLATION PLANT. Selecki, Anatol (Warsaw Technical Univ.). Nucl. Eng. Int.; 15: 717-9 (Sep 1970).

The production of heavy water by distillation of natural water is considered. It was concluded that the proposed multiple effect distillation might be competitive with other techniques for heavy water production and further investigation is justified. (auth) (UK)

225 EXTRACTION OF ZIRCONIUM(IV) FROM HYDROCHLORIC ACID SOLUTIONS BY TRI-n-BUTYL PHOSPHATE AND DI-(2-ETHYLHEXYL)-PHOSPHORIC ACID. Sato, Taichi (Shizuoka Univ., Hamamatsu, Japan). Anal. Chim. Acta; 52: 183-91(Nov 1970).

The partition of zirconium(IV) between hydrochloric acid solutions and solutions of tri-n-butyl phosphate (TBP) and of bis(2-ethylhexyl) phosphate (DEHPA) in kerosene was investigated under different conditions. The effect of organic solvent in the extraction by DEHPA was also examined. A high-resolution MMR study was made of the organic phases from the extraction by TBP and DEHPA. The mechanism of the extractions is discussed on the basis of the results obtained. (auth)

226 PYROMETALLURGICAL TREATMENT OF FLAT U_3O_8/ALUMINUM FUEL ELEMENTS. De Souza Santos, Tharcisio D. Metalurgia (Sao Paulo); 25: 681-5(Sep 1969). (In Portuguese).

The treatment of elements consisting of a core of U_3O_8/Al cermet and a sheath of Al is described. These elements had not been irradiated and thus presented no problem of fission products or radioactivity. Experiments were designed to test the feasibility of salvaging the natural U in scrap from the manufacture of fuel elements and in defective plates by incorporating it in an Al–U alloy. The treatment consisted basically of reductively melting the plates, which had been cut into pieces, by liquid Al protected by a molten cryolite bath. A graphite crucible was used. The direct pyrometallurgical treatment employed yielded U–Al alloys containing 23.8 to 30.2% U, with U recoveries of 93 to 98%. (Metals Abstr.)

227 RAPID COLUMN SEPARATIONS BY MEANS OF A SURFACE-SULFONATED EXCHANGE RESIN. Skafi, M.; Lieser, K. H. (Technische Hochschule, Darmstadt, Ger.). Z. Anal. Chem.; 251: 177-80(1970). (In German).

The use of superficially sulfonated ion exchange resins has the essential advantage that the separations can be achieved very rapidly and with dilute eluents. Some examples of column separations (Na/Cs, Cs/Sr, Cs/Y, Ba/Cs, and Sr/Y) confirm this result. (auth)

228 INVESTIGATIONS ON PRECIPITATION REACTIONS FOR THE ENRICHMENT OF TRACE ELEMENTS. V. ON THE SELECTION OF TRACE CATIONS CO-PRECIPITATED WITH INSOLUBLE SILVER PRECIPITATES. Jackwerth, E.; Graffmann, G. (Institut fuer Spektrochemie und Angewandte Spektroskopie, Dortmund, Ger.). Z. Anal. Chem.; 251: 81-91 (1970). (In German).

In view of an analytical application of precipitating main components the sorption reactions of many elements upon the silver precipitates AgCl, AgBr, AgI, AgSCN, AgCN, $AgBrO_3$, and $AgIO_3$ were investigated under identical conditions. The rate of sorption during the precipitation reaction was studied. The reversibility of the sorption reactions and the maximum concentration of trace elements adsorbed by a precipitate under constant conditions were determined. The variety of adsorbed elements and their co-precipitated amounts are tabulated. Because of the surface charge of the silver halogenides and silver thiocyanate trace elements are bound as a rule by adsorption, cations by negatively, anions by positively charged precipitates. In general the sorption reaction is reversible, when the direction of charge is reversed. It was not possible to identify the mechanism of the sorption of elements at AgCN, $AgBrO_3$, and $AgIO_3$. (auth)

229 ANION EXCHANGE METHOD FOR SEPARATING TELLURIUM AND HEAVY METALS. Busev, A. I.; Baghanly, I. L.; Bagbanly, S. I.; Guseinov, I. K.; Rustamov, N. Kh. (Moscow State Univ. Inst. of Inorganic and Physical Chemistry, Baku). Zh. Anal. Khim.; 25: 1374-8(Jul 1970). (In Russian).

The distribution coefficient of a number of elements under static conditions has been determined; the strongly basic AB-17 anion exchanger in the Cl-form was applied as a sorbent; a LiCl solution of various molar concentration was used as a complex forming reagent. In order to separate tellurium and heavy metal ions an LiCl concentration has been chosen at which a maximum difference in their distribution coefficients is observed. Tellurium can be separated from bicomponent systems: Te–Bi, Te–Pb, Te–Sb, Te–Au, Te–Fe, Te–Se, and from multicomponent systems containing Te(IV), Pb^{2+}, Bi^{3+}, Se(IV), Fe(III), Sb(III), Ag^+, Au(III), Ni^{2+}, and Al^{3+}. (auth)

230 SEPARATION OF OSMIUM AND RUTHENIUM BY SOLVENT EXTRACTION. Berg, Eugene W.; Moseley, H. E. (Louisiana State Univ., Baton Rouge). Anal. Chim. Acta; 47: 360-3(1969).

A method is described for the separation of Os and Ru by the extraction of the bromo compounds of the elements. The compounds are partitioned between hydrobromic acid solution and methyl isobutyl ketone, and the separations are followed with radioactive isotopes of Os and Ru. Studies were made on the effects of acidity and Os and Ru concentrations on the efficiency of extraction. It was found that there is an appreciable increase in the distribution coefficient of Ru and a decrease in the distribution coefficient of Os as the concentrations of Os and Ru increase. For quantitative separations the concentration of the two elements in the sample should not exceed 300 ppM. (P.C.H.)

231 SEPARATION OF RARE EARTHS FROM OTHER ELEMENTS BY SELECTIVE CATION EXCHANGE. Das, Ajit Kumar; Pal, Jaydeb Chandra; Banerjee, Siddheswar (Geological Survey of India, Calcutta). Anal. Chim. Acta; 47: 162-6 (1969).

Detailed studies of the conditions for the separation of rare earths from other elements in sulfosalicylate solutions by cation exchange are described. The separation of microgram amounts of rare earths from large quantities of Th or U and their spectrographic determination are also discussed; the procedure may be useful in the analysis of nuclear fuels. Ion exchange on Dowex 50W-X8 resin in the ammonium form in the presence of sulfosalicylate at pH 6.5 gave a clear separation of trivalent rare earths from Be, Al, Fe(III), Th, Mo(VI), and U(VI); separation from Ti(IV) and Zr must be carried out below pH 4.0. Separation from V(V) and W(VI) must also be done below pH 4.0 to avoid formation of the rare earth vanadate or tungstate. Beryllium cupferronate was found to be an effective carrier for rare earths, and the beryllium oxide matrix ultimately obtained burns smoothly in a carbon arc. AgCl helps in smooth volatilization of rare earths in the arc. (P.C.H.)

232 EXTRACTION CHROMATOGRAPHY OF URANIUM WITH DIOCTYL SULPHOXIDE. Fritz, James S.; Kennedy, David C. (Ames Lab., Iowa). Talanta; 17: 837-43(Sep 1970).

Uranium(VI) is quantitatively extracted from aqueous perchlorate media into dioctyl sulphoxide in 1,2-dichloroethane. The extracted species contains four sulphoxides for each uranium. Most other metal ions are not appreciably extracted. On columns containing a solid support impregnated with dioctyl sulphoxide in 1,2-dichloroethane, uranium(VI) may be separated quantitatively from metal ions such as thorium(IV), zirconium(IV), and rare earths(III). (auth) (UK)

233 SYNERGIC EXTRACTION OF THE EUROPIUM(III)-BIS-PHENANTHROLINE-TRIS-SALICYLATE COMPLEX AND THE PREPARATION AND PROPERTIES OF ANALOGOUS TERNARY RARE EARTH COMPLEXES. Sinha, S. P.; Irving, H. M. N. H. (Univ. of Leeds, Eng.). Anal. Chim. Acta; 52: 193-205(Nov 1970).

Solid ternary complexes of the composition $M(phen)_2(R \cdot C_6H_4 \cdot CO_2)_3$ were prepared from a number of rare earth cations, M^{3+}, with 1,10-phenanthroline (phen) and benzoic acid, salicylic acid, or p-hydroxybenzoic acid. Only those complexes formed with salicylic acid could be extracted by benzene from aqueous solutions of the components, and radiometric studies from solutions of constant ionic strength I = 0.1 M ($NaClO_4$) showed the extract-

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able species to be a bis-phenanthroline–tris-salicylate complex. Infrared studies of the solid complex suggest the presence of both chelated and unchelated salicylate ions ($HSal^-$). Fluorescence spectra indicate that the europium(III) complex is octa-coordinated and should be formulated as $[Eu(phen)_2(HSal)_2]^+[HSal]^-$. The partition coefficients of 1,10-phenanthroline and salicylic acid between benzene and water are 3.84 and 1.7, respectively, and the acid is dimerized in benzene with $K_{dim} = 35$. (auth)

234 SOLVENT EXTRACTION OF THULIUM WITH ALIPHATIC MONOCARBOXYLIC ACIDS. Schweitzer, George K.; Sanghvi, Sarjula M. (Univ. of Tennessee, Knoxville). Anal. Chim. Acta; 47: 19-25(1969).

The extraction of 10^{-4} and 10^{-3} M thulium(III) into 4-methyl-2-pentanone and chloroform containing aliphatic monocarboxylic acids has been studied with formic through decanoic acids. Extraction tends to increase with acid molecular weight, acid concentration, and pH up to about 6. Detailed studies with hexanoic acid indicated that the species extracting into 4-methyl-2-pentanone is $TmR_3(HR)$ and the species extracting into chloroform is $TmR_3(HR)_5$. In both cases the predominant aqueous species are Tm^{3+} and $TmOH^{2+}$. From the data first hydrolysis constants of Tm^{3+} have been calculated to be $10^{-10.2}$ and $10^{-9.7}$, these values being larger than those expected from previous rare earth hydrolysis data. (auth)

235 CATION-EXCHANGE SEPARATION OF COBALT(II) ON DOWEX 50W-X12. Akki, S. B.; Khopkar, S. M. (Indian Inst. of Tech., Bombay). Anal. Chim. Acta; 52: 393-6(Nov 1970).

The cation-exchange behavior of cobalt on Dowex 50W–X12 with different eluents was studied. On the basis of elution constants and volume distribution coefficients, the eluents may be arranged in order of decreasing efficiency as follows: $Na_2SO_4 = (NH_4)_2SO_4 = NaCl = NH_4Cl = NaNO_3 < HCl < HNO_3 < HClO_4 < CH_3COONH_4$. Separations from Zn, Be, Co, Rb, Cd, Ba, Cu, U, Tl, Pb, Sr, Ti, Mg, Sn, and Ni were studied. (M.C.G.)

236 PASSIVATION OF URANIUM DIOXIDE CATHODIC DEPOSITS IN CHLORIDE MELTS. Baraboshkin, A. N.; Kaliev, K. A.; Tarasova, K. P. Elektrokhimiya; 6: 146-9(Jan 1970). (In Russian).

It is shown that the nucleation of uranium dioxide crystals on platinum cathodes, during separation from chloride melts, required an over-voltage, the magnitude of which depended on the conditions of electrolysis. Repeated cathode polarization of the electrode during formation of the dioxide crystals occurred. All experiments were made at 400°C. Uranyl chloride concentration in the melt was 7 to 21 wt %. Experiments showed that passivation disappeared in tetrachlorides with a minimum concentration of 0.3 wt %. (tr-auth)

237 EXTRACTION OF PLUTONIUM BY FLUORIDE MELTS. Novoselov, G. P.; Kashcheev, I. N.; Dogaev, Yu. D. This paper was summarized in At. Energ. (USSR); 28: 49(Jan 1970) as paper No. 359/5386. (In Russian).

Plutonium was extracted from uranium using a mixture of lithium and calcium fluorides in a 1 : 10 ratio (by weight). At the temperature 1523°K, 96 to 98% of the plutonium was extracted in 10 to 30 min from weighed samples of 1 to 3 g of the alloy, containing 0.3 mg/g of plutonium, while the passage of uranium into the salt did not exceed 5%. Plutonium was also completely extracted from Pu–Ni–Cu alloys under analogous conditions, while no formation of copper and nickel fluorides was detected. Mixing of the salt phase with a rotating mixer did not lead to any significant increase in the rate of extraction of plutonium. Results of the experiments with Pu–Ni–Cu alloys show that the extraction of plutonium occurs directly according to the reaction: $Pu + 3LiF \rightarrow PuF_3 + 3Li$. In meltings in an induction furnace, where the metallic phase was intensively mixed with an electromagnetic field, the extraction was higher than in resistance furnaces. The diffusion of plutonium in the metallic phase is considered to be the limiting step of the process. (M.C.G.)

238 FOAM SEPARATION OF RADIORUTHENIUM. Kepak, F.; Kriva, J. (Inst. of Nuclear Research, Rez, Czech.). Separ. Sci.; 5: 385-91(Aug 1970).

Foam separation of radioruthenium as Ru(IV) and RuNO(III) by the surface-active agents dodecylamine and gelatin from aqueous solutions was studied. The multistage separation of Ru(IV) with dodecylamine was effective and more than 99% of Ru(IV) was separated from the solution. (auth)

239 PROCESS FOR THE LIQUID–LIQUID EXTRACTION OR URANIUM AND PLUTONIUM. (to Gesellschaft fuer Kernforschung mbH). British Patent 1,207,288. 30 Sep 1970. Priority date 23 Mar 1968, Germany.

A process is described for recovering U and Pu from fuels containing only a small quantity of Pu, such as fuels of low burnup or highly enriched fuels, by dissolving the fuel mixture in aqueous acid, extracting the U and Pu from the acid solution with an organic solution of a quaternary organic ammonium nitrate, and re-extracting the U into an aqueous phase. The Pu remains in the organic extractant and is recycled to the extractor for further extraction of Pu and U. After several cycles, a portion of the stream is led off for the recovery of the Pu. (B.L.M.)

240 IMPROVEMENTS IN HIGH SPEED MIXING SEPARATORS. (to Gesellschaft fuer Kernforschung mbH). British Patent 1,206,503. 23 Sep 1970. Priority date 25 Apr 1967, Germany.

A high-speed mixing separator suitable for fuel reprocessing plants includes a housing and a vane pump enclosed in a mixing chamber and adapted to induce from separate pipes and to mix at least two phases of different specific weight. A hollow cylindrical rotor arranged vertically coaxially adjoins the mixing chamber with the base of the rotor having a central inlet opening through which a driving shaft for the vane pump passes. The shaft engages webs located in the rotor. The rotor engages a ring weir for the individual phases having radial outlet openings associated with the wier. Ring passages are provided in the housing for discharge of separated phases. The driving shaft of the vane pump leads into the rotor and is firmly connected with it while the driving shaft of the rotor is detachably connected with a rotor end plate. (B.L.M.)

241 IMPROVEMENTS IN OR RELATING TO THE PROCESSING OF IRRADIATED NUCLEAR FUELS. Mills, Alfred Leonard; Vivers, Robert William Jackson (to United Kingdom Atomic Energy Authority). British Patent 1,206,449. 23 Sep 1970. Filed 19 Dec 1967.

Dissolution in HNO_3 of irradiated monocarbide fuel containing U and Pu, for example, the single-phase solid solution (U,Pu)C, is described. One of the problems of direct dissolution is that complex organic compounds are produced by action of the acid on the fuel and these give rise to difficulties in the subsequent extraction process, interfering with solvent/aqueous phase disengagement and complexing the Pu present in solutions. The irradiated carbide fuel is dissolved in HNO_3 and the solution subjected to the oxidizing action of ozone or to electrolytic oxidation to effect oxidation of organic compounds without oxidizing the Pu in solution to the hexavalent state. Controlled oxidation is necessary to prevent oxidation of the Pu, and redox potential or spectrophotometric measurements are made to indicate removal of the organic material and to indicate the onset of Pu(VI) formation. (UK)

242 PROCESS AND APPARATUS FOR THE RECOVERY OF PLUTONIUM OR URANIUM. Bouzou, Georges (to Commissariat a l'Energie Atomique). British Patent 1,206,748. 30 Sep 1970. Priority date 22 Mar 1968, France.

A method and apparatus are described for the recovery of Pu or U that is retained in the slag derived from the preparation of these metals by calciothermic reduction. The slag, which was previously ground and heated to a temperature higher than 700°C, is discharged into a cooled concentrated HNO_3 solution. The solution is filtered in order to separate the CaF_2 from the HNO_3 solution of Pu or U. (B.L.M.)

243 DEVELOPMENT OF A PROCESS FOR REPROCESSING GRAPHITIC FEED AND BREED ELEMENTS BY CHLORINATION. Fischer, E.; Laser, M.; Merz, E. (Kernforschungsanlage, Juelich, Ger.). Kerntechnik; 12: 321-6(Aug 1970). (In German and English).

For the reprocessing of thorium-containing nuclear fuel elements a high-temperature chlorination head-end process was developed. The fuel elements must be crushed and ground. The particle size should be smaller than 0.3 mm. The ground product is chlorinated in a continously working fixed-bed reactor at about 1000°C. The condensation of the chlorides results in a finely powdered product. (auth)

244 LABORATORY AND HOT-CELL EXPERIMENTS ON THE APPLICABILITY OF THE ACID THOREX PROCESS FOR RECOVERY OF THORIUM REACTOR FUEL WITH HIGH BURNUP. Kuechler, L.; Schaefer, L.; Wojtech, B. (Farbwerke Hoechst AG, Frankfurt am Main). Kerntechnik; 12: 327-33(Aug 1970). (In German and English).

As was shown in laboratory and hot-cell experiments the Acid Thorex process is also suitable for reprocessing thorium fuel with high uranium content (up to 20% with respect to thorium) and high fission product contents (burnup of 100,000 MWd/t) if a modified flowsheet compared to that one published in literature is applied and if ZrO_2 hydrate, which precipitates during feed adjustment, is removed prior to extraction. In reprocessing irradiated nuclear fuel with burnups up to 54,000 MWd/t the

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following decontamination factors were obtained in one cycle: gross γ 10^4 to 10^6, Ce > 5×10^6, Zr 10^5 to 10^6, Ru 10^3 to 10^4. A flowsheet using a zirconium-containing acid feed resulted in decontamination of the uranium and thorium product from gross γ activity by factors of 10^3 and $<10^2$, respectively. (auth)

245 SEPARATION OF UF_6 FROM A FLUORINE CONTAINING CARRIER GAS BY ABSORPTION ON NaF IN THE CONTEXT OF DRY REPROCESSING OF NUCLEAR FUELS CONTAINING THORIUM. Kuhrt, W.; Friedrich, H.; Kreutz, R.; Massonne, J. (Kali-Chemie AG, Hanover). Kerntechnik; 12: 334-7(Aug. 1970). (In German and English).

The separation of UF_6 from a fluorine-containing carrier gas by sorption on NaF pellets at 100°C was studied experimentally over a range of carrier gas flow rates, UF_6 mass flow rates, and absorption times. Data are given for calculating the absorber capacity for the absorber model used. The desorption of UF_6 of 400°C is virtually total. (auth)

246 DISINTEGRATION OF GRAPHITE BY THE FORMATION OF ELECTROLYTIC GRAPHITE INTERCALATION COMPOUNDS. Merz, E. (Kernforschungsanlage, Juelich, Ger.). Kerntechnik; 12: 341-6(Aug 1970). (In German and English).

The effects of formation of electrolytic graphite intercalation compounds on the disintegration of a graphite matrix were systematically investigated in the context of reprocessing of graphitic fuel elements. The graphite body to be disintegrated forms the anode in an appropriate strongly acidic electrolyte; the most suitable cathode material is platinum. A nearly complete separation of the matrix graphite from the nuclear fuel and breeder particles is achieved by a continuous flotation process. The several parameters affecting the speed and the completeness of disintegration, including the kind, composition and concentration of the electrolyte, the geometric arrangement of the electrolysis, the temperature of the electrolyte, the current intensity and the power consumption, were investigated in detail, and conclusions were drawn from the findings regarding the probable reaction mechanism involved. The prospects of an engineering application of the method for reprocessing graphitic fuel elements are discussed. (auth)

247 IN-LINE INSTRUMENTATION IN THE REPROCESSING OF IRRADIATED NUCLEAR FUELS. Baumgaertel, G. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.); Finsterwalder, L. Kerntechnik; 12: 347-55(Aug 1970). (In German and English).

In reprocessing plants a complete control of all process parameters is necessary. This control can be achieved particularly expediently by automatic on-line instruments. A survey of useful on-line instruments for the determination of uranium, plutonium, nitric acid, and fission products during reprocessing is presented. A distinction is drawn between instruments functioning without additive reagents and those that need special reagents for the determination of the desired process parameter. (auth)

248 OXYGEN ISOTOPE SEPARATION FACTOR AT EQUILIBRIUM OF WATER VAPOR WITH BASIC AQUEOUS SOLUTIONS. Preobrazhenskaya, L. B.; Nedumova, E. S.; Zel'venskii, Ya. D. This paper was summarized in At. Energ. (USSR); 28: 51-2(Jan 1970) as paper No. 363/5369. (In Russian).

It is shown that the ^{18}O enrichment factor can be increased by a factor of almost three over that of the water-fractionization process through the use of a phase exchange between water vapor and aqueous KOH solutions. The value of α, the equilibrium oxygen-isotope separation factor for the equilibrium of water vapor with aqueous solutions of inorganic (KOH) and organic (monoethanolamine-MEA) bases, was determined experimentally, and the dependence of α on the temperature and the base concentration was studied. Mass-spectrometric analyses were made of the oxygen in the samples. It was found that when water vapor was brought into equilibrium with an aqueous KOH solution, the heavy isotope of oxygen concentrated in the vapor phase; the value of α increased with an increase in the KOH concentration. For a 20% KOH solution at 30 torr, the enrichment factor was 0.03, while that for fractionization of pure water was $\alpha_0 = 0.008$. The increase in the oxygen isotope separation factor in the presence of KOH may be due to an isotope exchange reaction between the water and the hydroxyl in the liquid phase. The equilibrium in the MEA solution-water vapor system was studied over the pressure range 100 to 760 torr at MEA concentrations of 5-25 mole %. The heavy oxygen isotope concentrated in the liquid phase in the presence of the MEA; the oxygen isotope separation factor decreased with increasing MEA concentration. (M.C.G.)

249 ACTIVITIES OF UGINE KUHLMANN IN THE FIELD OF NUCLEAR INDUSTRY. Renaud, J. (Ugine-Kuhlmann, Paris). Energ. Nucl. (Paris); 12: 313-17(Jul-Aug 1970). (In French).

Ugine-Kuhlmann's activities in the different stages of the nuclear fuel cycle are presented: mining, ore processing, preparation of ore concentrates, preparation of UF_4, UF_6, and UO_2. The new process used in Mol (Belgium) for the production of UF_4 by electrochemical reduction of uranyl nitrate is outlined. (auth) (France)

250 THIN-LAYER CHROMATOGRAPHY OF THE RARE EARTH ELEMENTS USING A WEAKLY BASIC CELLULOSE ION EXCHANGER, DEAE. Ishida, Koji (Kyorin Univ., Tokyo). Jap. Anal.; 19: 1250-4(Sep 1970). (In Japanese).

Thin-layer chromatographic behavior of the rare earths on DEAE in methanol-nitric acid media was investigated. R_f values were measured as functions of the solvent volume ratio and the concentration of the nitric acid. They increased generally with atomic numbers of the rare earths up to dysprosium, being kept approximately constant on going further to the higher atomic numbers. Controlling the solvent volume ratio and the nitric acid concentration yielded large differences in adsorption among the rare earths, thus allowing good separations. The maximum resolutions of the adjacent rare earths from lanthanum to neodymium were obtained by using as the developing solvents methanol-8N nitric acid (5 : 1, v/v) and methanol-1N nitric acid (20 : 1, v/v). On the other hand, the resolutions of the adjacent rare earths from neodymium to dysprosium were better, the higher the solvent volume ratio and the nitric acid concentration. The good separation of samarium, europium, and gadolinium from each other was accomplished by the ascending technique with methanol-14N nitric acid (20 : 1, v/v). (auth)

251 PROCESS FOR THE SEPARATION OF ELEMENTS OF THE LANTHANIDE GROUP OR ELEMENTS OF THE TRANSPLUTONIUM GROUP WHICH ARE PRESENT IN AN AQUEOUS GROUP. Coupat, Bernard; Musikas, Claude (to Commissariat a l'Energie Atomique). British Patent 1,206,038. 23 Sep 1970. Priority date 17 Nov 1967, France.

Elements of the lanthanide rare earth group of elements or of the transplutonium group were separated by passing an aqueous solution in nitrate form containing alcohol through an anion exchange resin column in nitrate form to absorb the elements and elute them. The eluting solution contained nitrate ions, alcohol (preferably ethanol), and a complexing agent consisting of an ethyleneamineacetic acid, preferably diethylenetriaminepentaacetic acid. (B.L.M.)

252 INVESTIGATION OF HEAT TRANSFER IN ATOMIZATION DRYING OF SOLUTIONS WITH HEAT SUPPLIED BY THE HIGH-TEMPERATURE WALLS OF CYLINDRICAL REACTION VESSELS. Gamrekeli, M. N.; Davydov, V. I. This paper was summarized in At. Energ. (USSR); 24: 259-60(Mar 1968) as paper No. 188. (In Russian).

The experimental equipment and the method used for investigating the heat transfer in the atomization of water and liquids simulating radioactive waste are discussed. The reaction vessel constitutes a vertical tubular furnace with direct heating. (B.L.M.)

253 COMPARISON OF SOME EXTRACTANTS FOR THE EXTRACTION AND SEPARATION OF TANTALUM, NIOBIUM, AND TITANIUM. Chufarov, I. G.; Petunina, N. I. Zh. Vses. Khim. Obshchest. im. D. I. Mendeleeva; 14: 351-2(1969). (In Russian).

2-Furaldehyde (I), benzaldehyde (II), and C_4 to C_{18} alcohols were tested as extractants for Ta, Nb, and Ti from media 10M in HF plus 2M in H_2SO_4, or 8M in HCl plus 2M in H_2SO_4. (I) was found to be a good selective extractant for Ta in the HF solution (distribution coefficient K = 51.6) in the presence of Nb (K = 0.2) and Ti (K = 0.004); traces of Nb and Ti could be removed from the extract by re-extraction into H_2SO_4 and NH_4F solution. For Ta, K was 31.1 with (II), and decreased from 15.6 with butanol to 0.06 with secondary C_{12} to C_{18} alcohols. From the HCl medium, Ta and Ti had low values of K, but Nb was extracted by C_6 to C_{18} alcohols; the value of K increased with the chain length. With <6M-HCl, Nb was present mainly in cationic form and extraction was very slight. Tantalum could be extracted into the alcohols from fresh solution containing <10M-HCl, but extraction decreased with age of the solution because of polymerization of the Ta. With the higher primary alcohols, K for Ta was 30 to 50, and 98 to 99% of the Ta was recovered by one extraction. (anal. abstr.)

254 NOTE CONCERNING THE DETERMINATION OF FILTER EFFICIENCY FOR RADON DAUGHTERS. Riedel, M. Kernenergie; 13: 184-6(Jun 1970). (In German).

Alpha decays of the short-lived radon daughters, for ^{218}Po and ^{214}Po separately, were measured on a fiber filter of the FPP-15 type having a weight of 4 mg/cm^3 based on perchlorovinyl. Collection was made on the filter at a flow rate of 30 cm/sec. Atmospheric air was used as the carrier of the daughters. Connecting

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three filters in series, the aerosol spectrum can be shown to vary significantly in passing the filters. Filter efficiencies were approximately determined and compared with the results obtained by two-filter technique. For 14 three-filter experiments the filter efficiency was found to be smaller than 0.8. An attempt was made to estimate the most important errors and their magnitude. (auth)

255 1,1-DIANTIPYRINYLETHANE AS AN EXTRACTION REAGENT FOR SEPARATING THORIUM FROM OTHER ELEMENTS IN THIOCYANATE MEDIUM. Zhivopistsev, V. P.; Pyatosin, L. P. (Perm State Univ., USSR). Uch. Zap., Perm. Gos. Univ.; No. 178, 168-73(1968). (In Russian).

The optimum conditions for extraction of Th from thiocyanate solution by a solution of the title reagent (I) in dichloroethane were determined as a function of the concentration of I, NH_4SCN and HCl. From 5 to 10 mg of Th was extracted completely by 15 ml of dichloroethane from 15 ml of aqueous solution containing 2.5 to 3 g of I, 10% of NH_4SCN and 0.25N in HCl. This procedure was used for the separation of Th from elements interfering with its complexometric determination, after which the Th was re-extracted into H_2O, the solution adjusted to pH 2 with aqueous NH_3 and titrated with EDTA in the presence of xylenol orange. In the re-extraction of Th from the organic phase the reagent is regenerated and can be used again. Compared with a similar method of determining Th with the same reagent but without thiocyanate (Analyt. Abstr., 1969, 16: 1178) the proposed method is simpler, although less selective. The following metals do not interfere in the determination— Al, Zn, Cd, Mn, Co, Cr, Pb, Ce, Be, Ba, Ca, and Mg. (Referativnii Zh.)

256 STUDY OF THE KINETICS OF THE ELECTROLYTIC SEPARATION OF HYDROXIDE DEPOSITS OF RARE-EARTH ELEMENTS. Brezhneva, N. E.; Kapshaninov, Yu. I.; Oziraner, S. N. This paper was summarized in At. Energ. (USSR); 24: 462(May 1968) as paper No. 201. (In Russian).

Studies were made on the laws governing the electrolytic separation of rare earth elements (Y, Ce, Pm) from an aqueous medium. The method developed solved the problem of separation of radioactive elements from a metallic substrate in the form of a thin even layer with a high specific radioactivity in which the self-absorption of β particles would be a minimum. The results showed that the electrolytic separation takes place as a result of hydrolysis near the cathode, where there is a high concentration of hydroxyl ions. Almost complete separation of the element takes place in 1 to 2 hr if the solution contains no elements (such as Fe) which prevent the deposition of the principal element. (P.C.H.)

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EARTH SCIENCES

Geology and Hydrology

Refer also to abstracts 47, 60, 155, 359, 374, 454, 474, 518, and 1845.

257 (CEA-R-4061) INTERPRETATION OF GAMMA LOGGING FROM NATURAL SELECTIVE RADIOACTIVE DRILLINGS. Czubek, Jan A. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Sep 1970. 27p. (In French). Dep. NTIS (U. S. Sales Only).

A relation between the uranium content q_u and the effective attenuation coefficients of the gamma radiation μ_1 and μ_2, at two given energy ranges ($100 < E < 133$ KeV for μ_1 and $300 < E < 700$ KeV for μ_2) and the diffused gamma intensities I_1 and I_2 measured in the same ranges was established for an infinite homogeneous medium. A manual interpretation process is described which makes it possible to determine the content q_u and power H of the mineralized layer for each anomaly. Finally the same result can be obtained by another method of calculation adapted to computers. (auth) (France)

258 (DOCKET-50201-48) WEST VALLEY REPROCESSING PLANT. Environmental Report No. 7, July-December 1969. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 1 Sep 1970. 12p. Dep. NTIS.

The results of radiation monitoring in the environs of the Nuclear Fuels Services site at West Valley, N. Y. are presented. During the second half of 1969, the average concentration of gross radioactivity and the average concentration of specific radionuclides in samples of air, fallout, milk, water and silt continued to be less than applicable limits of the U. S. Atomic Energy Commission and the Federal Radiation Council. Airborne particulate activity continued to be less than pre-operational levels. Radioactivity in fallout at NFS site remains below the levels found for the average station in the United States Public Health Service countrywide network. Controlled discharges of low-level liquid wastes have held concentrations at the site perimeter to less than 18% of the always-safe concentrations. Radioactivity from ^{90}Sr in milk continues to be typical of environmental levels reported throughout the state. Total beta activity in Cattaraugus Creek silt continues to decrease with ^{90}Sr currently less than 2% of the total beta activity. (auth)

259 (DOCKET-50201-49) WEST VALLEY REPROCESSING PLANT. Environmental Report No. 8, January-June 1970. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 22 Sep 1970. 12p. Dep. NTIS.

The results of radiation monitoring in the environs of the Nuclear Fuels Services site at West Valley, N. Y. are presented. During the first half of 1970, the average concentration of gross radioactivity and the average concentration of specific radionuclides in samples of air, fallout, milk, water and silt continued to be less than applicable limits of the U. S. Atomic Energy Commission and the Federal Radiation Council. Airborne particulate activity continued to be less than pre-operational levels. Radioactivity in fallout at NFS site remains below the levels found for the average station in the United States Public Health Service countrywide network. Controlled discharges of low-level liquid wastes have held concentrations at the site perimeter to less than 18% of the always-safe concentrations. Radioactivity from ^{90}Sr in milk continues to be typical of environmental levels reported throughout the state. Total beta activity in Cattaraugus Creek silt continues to decrease with ^{90}Sr currently less than 2% of the total beta activity. (auth)

260 (IDO-12073, pp 43-5) U. S. GEOLOGICAL SURVEY. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

From annual report, 1969.

The U. S. Geological Survey investigated the geology and water resources at the NRTS and adjacent areas. The effects of liquid low-level radioactive waste disposal to subsurface water are of particular interest. Natural changes in the geohydrology and changes brought about by activities at the station are studied and defined. During 1969 hundreds of measurements were made to determine changes in ground water level, the chemical and radiochemical composition of the ground water, the water and rock properties, and the flow of the Big Lost River. The effects of underground disposal of low-level liquid radioactive wastes were investigated, and a program for evaluating contamination of the Snake Plain aquifer by burial of solid wastes was prepared. A digital computer model was completed for predicting the magnitude of rare catastrophic floods and their effects on the NRTS. A seismic study for determining the potential for faulting and earthquakes on the NRTS was completed. Two faults near Arco and Howe were revealed, but little seismic activity was found. (L.C.L.)

261 (ORNL-IIC-21) ISOTOPIC METHODS OF EXAMINATION AND AUTHENTICATION IN ART AND ARCHAEOLOGY. Miller, F. J.; Sayre, E. V.; Keisch, B. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 65p. Dep. NTIS.

A review is presented of the various isotopic methods that have been used for the examination and authentication of objects of artistic and archaeological interest. The techniques discussed include thermoluminescence dating of pottery; dating by measurement of natural alpha emitters; nuclear track dating; radiocarbon dating; beta, gamma, and x-ray radiography; nondestructive activation analysis by use of neutrons and charged particles; and x-ray fluorescence analysis of coins and jewelry. Discussions of the significance of the various techniques to art historians and archaeologists are included. (auth)

262 (STI/PUB-255) ISOTOPE HYDROLOGY 1970. Proceedings Series. Proceedings of a Symposium on Use of Isotopes in Hydrology Held in Vienna, 9-13 March 1970. (International Atomic Energy Agency, Vienna (Austria)). Sep 1970. 930p. (In several languages). (CONF-700328). IAEA $24.00.

Fifty-three papers given the Symposium on Uses of Isotopes in Hydrology at Vienna on March 9 to 13, 1970 are presented. The subjects discussed include the distribution of radioisotopes in ground and surface waters, ^{14}C dating of ground water, radioisotope tracer studies of sediment and water movement, radiometric well logging, reservoir leakage detection, and mathematical models for hydrologic studies, such as the distribution of radioisotopes around nuclearly excavated sea-level canals. (L.C.L.)

263 SHORT-LIVED DAUGHTER RADON PRODUCTS DISTRIBUTION OVER AEROSOL PARTICLES IN THE MINE AIR. Savenko, E. I.; Serdyukova, A. S. Izv. Vyssh. Ucheb. Zaved., Geol. Razved.; No. 3, 123-7(Mar 1970). (In Russian).

In the inactive working areas of mines the maximum distribution of short-lived radon daughter products appear as aerosol particles of about 0.30 μmm, which is in good agreement with published data for an unconfined atmosphere. In average sampling of all the mine stops, nearly 90% of the particles carrying radon daughter products have dimensions less than 0.009 μmm and a maximum distribution corresponding to the average dia of 0.0065 μmm. Contaminated air in mines contains dust particles of 0.4 to 2.1 mg/mm^2 with maximum distribution of radon daughter products changing into aerosol particles with larger dimensions from 0.055 to 0.072 μmm. (tr-auth)

264 FAST DETERMINATION OF Cu-MINERALIZATION AT THE NOVOVESKA HUTA ORE-BEARING DEPOSIT BY GAMMA-GAMMA LOGGING. Simon, L. (Mining Inst., Prague). Rudy (Prague); 17: 95-6(Mar 1969). (In Czech).

The results of gamma-gamma determination of Cu-mineralization of small diameter boreholes carried out by means of the HOU22S gamma-gamma logging device developed at the Mining Institute of the Czechoslovak Academy of Sciences in Prague are described. Selenium-75 was used as the radiation source. Detailed measurements showed that gamma-gamma technique is a reliable method for determining the Cu content in the Novoveská Huta ore-bearing deposit. (NSA of Czech.)

265 EFFECT OF SAMPLE INHOMOGENEITY IN K-Ar DATING. Engels, J. C.; Ingamells, C. O. (Geological Survey, Menlo Park, Calif.). Geochim. Cosmochim. Acta; 34: 1007-17(Sep 1970).

Error in K-Ar ages is often due more to deficiencies in the splitting process, whereby portions of the sample are taken for potassium and for argon determination, than to imprecision in the analytical methods. The effect of the grain size of a sample and of the composition of a contaminating mineral can be evaluated, and this provides a useful guide in attempts to minimize error. Rocks and minerals should be prepared for age determination with the effects of contaminants and grain size in mind. The magnitude of such effects can be much larger than intuitive estimates might indicate. (auth) (UK)

266 EXPLORATION FOR URANIUM ORE DEPOSITS BY GAMMA RAY LOGGING. Kaku, Ichiro (Power Reactor and

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Nuclear Fuel Development Corp., Tokyo). Butsuri Tanko; 22: 210-19(Sep 1969). (In Japanese).

Intensive investigations of methods for prospecting for uranium in Japan have been conducted since 1956. An effort was made to develop the gamma logging method for locating uranium ore deposits in the stage of exploration drilling. The history of logging procedures, gamma logging equipment, the method of detection of radioactive anomalies and calculation of ore reserves from the drill hole data are discussed, and examples of Ningyo-Toge Mine Nakatsugo ore deposit are presented. (auth) (Japan)

267 SEARCH FOR MINERALS WITH NEUTRONS. Wylie, A. W.; Eisler, P. L. (Commonwealth Scientific and Industrial Research Organization, Melbourne). Philips Tech. Rev.; 30: 99-109(Feb 1970). (In German).

Borehole logging by nuclear techniques is a very promising alternative for the time-honored but expensive method of core drilling in the search for minerals. The procedure discussed consists in lowering into the drill hole a source of fast neutrons which excite gamma radiation from the material of the wall of the hole. This radiation is detected by a scintillator crystal with photomultiplier mounted on top of the neutron source and suitably shielded from the direct beam of source radiation. From the pulses transmitted to the surface the energy spectrum of the radiation is derived by a multichannel pulse-height analyzer and recorded during the lowering operation. A discussion of the nuclear processes involved and the equipment used shows the importance of using a pulsable neutron source. Two types of sealed neutron generator tubes are suitable for the purpose. The problem of deriving the relevant information from the radiations detected is considered in some detail and experimental means for investigating this problem by simulating possible borehole situations are described. (auth) (INIS)

268 RECENT DEVELOPMENTS IN POTASSIUM-ARGON DATING. York, Derek (Univ. Toronto). Comments Earth Sci., Geophys.; 1: 47-54(Aug-Sep 1970).

The history of Ar/K dating of geological samples is reviewed, and recent developments for improving the precision of Ar/K dating so that the method can be used in an age range beyond 4.5 Myr and for the dating of shields are presented. These developments include analytical refinements that reduce the age determination errors caused by atmospheric argon contaminations and by sampling errors and controlled heating studies of irradiated rocks and minerals to reduce errors caused by the thermal histories of shields. (L.C.L.)

269 RADIOACTIVITY OF SURFACE AND GROUND WATERS. Pazdernik, J. (Water Research Inst., Prague). Vod. Hospod., B; 19: No. 3, 80-1(Mar 1969). (In Czech).

A brief survey is given of radiochemical methods used for determining both the natural and artificial radioactivity of water in the most important waterworks and streams in Czechoslovakia. The main purpose of studying the radioactivity of waters is to determine conditions under which the quality of river and groundwaters is in accordance with act No. 34/1963 of the CSSR digest, and to ascertain and restrict the influence of radioactive pollution sources on surface and groundwaters according to the act. The following methods for determining natural radioactivity are mentioned; the extraction dithizone method for ^{210}Pb determination; the ion exchange method; the chemical precipitation and evaporation method for total beta activity measurement; fluorometric and spectrophotometric methods for Th determination; the classical emanometric method; and the scintillation method for ^{226}Ra determination. As for artificial radioactivity, a brief account is given of ^{90}Sr and ^{137}Cs determination. (NSA of Czech.)

270 URANIUM-LEAD RADIOACTIVE AGES OF MONAZITE AND ZIRCON FROM THE VIRE-CAROLLES GRANITE (NORMANDY). A CASE OF ZIRCON-MONAZITE DISCREPANCY. Pasteels, Paul. Eclogae Geol. Helv.; 63: 231-7(Apr 1970).

Uranium-lead age determination performed on two monazite samples from the Upper Precambrian Vire-Carolles granite (Lower-Normandy) suggests an age attribution of 570 ± 25 Myr for this granite, a result slightly higher or similar to biotite Rb-Sr and K-Ar ages obtained by other contributors. This figure may represent an upper limit for the base of the Cambrian. Two zircon samples yield 207/206 ages which are obviously too high. They are considered as indicative of the presence of zircon xenocrysts. (auth)

271 URANIUM-LEAD RADIOACTIVE DATING AND LEAD ISOTOPE STUDY ON SPHENE AND K-FELDSPAR IN THE SOER-RONDANE MOUNTAINS, DRONNING MAUD LAND, ANTARCTICA. Pasteels, Paul; Michot, Jean (Univ. Libre, Brussels. Vrije Univ., Brussels). Eclogae Geol. Helv.; 63: 239-54(Apr 1970).

Uranium-lead radioactive ages of sphene samples extracted from igneous and metasedimentary rocks of the Sor-Rondane Mountains (Antarctica) are compared with the zircon U/Pb ages, previously obtained, and with some Rb/Sr data. The behaviour of sphene in amphibolite facies metasediments is strikingly different from that of zircon. This latter mineral is predominantly detrital, suffering from partial lead loss during the metamorphism, while sphene, being a metamorphic mineral, should essentially yield the age of metamorphism. Surprisingly, sphene from metasedimentary gneisses constantly shows an age of 540 Myr which is lower than the zircon age (600 Myr) of the two geologically younger, cross-cutting intrusives. Therefore, sphene either suffers from extensive lead loss until some threshold point of non-diffusion is reached in the course of the post-metamorphic upheaval, or the investigated granites contain zircon xenocrysts. The first possibility is favoured. Such a zircon-sphene discrepancy is not observed in the case of a younger intrusive (500 Myr old). In order to obtain sufficient precision on the 206/207 ages, a study of the isotopic composition of the feldspar lead has been necessary. The joint investigation of uranium-lead isotopic relationships in sphene, zircon, K-feldspar, might yield useful petrogenetic information in some cases. (auth)

272 THEORY OF THE GEOPHYSICAL GAMMA-GAMMA MEASUREMENTS IN A 2π GEOMETRY. PART I. MONTE CARLO CALCULATIONS. Umiastowski, Kryzysztof (Inst. of Nuclear Techniques, Krakow). Nukleonika; 15: 37-46(1970).

The Monte Carlo programs, which have been used for the calculation of photon transport in the case of a 2π geometry are discussed. The assumptions postulated for these calculations are discussed. Sets of approximately 3000 photon histories were calculated for each of the initial energies of 0.279 MeV, 0.662 MeV, and 1.25 MeV, the media being water and aluminium. The values of the number albedo and angle-energy distributions of photons leaving the medium are given. The maximum number of photon collisions to be taken into account is also given; this number does not exceed 12. (auth)

273 EXPERIMENTAL VERIFICATION OF THE UNIVERSAL CALIBRATION CURVE FOR GAMMA-GAMMA DENSITY LOGGING. Rychlicki, Stanislaw (Inst. of Petroleum Engineering, Krakow); Umiastowski, Krzysztof. Nukleonika; 15: 47-54(1970).

The existence of the universal calibration curve for gamma-gamma density meters was verified based on experimental data of various authors. The shape of the curve was found to be independent on the primary photons energy. In addition, the validity of the analytical formula for describing the shape of the curve was tested. (auth)

274 U/Pb ZIRCON AGES AND POLYCYCLISM OF THE GNEISS DE BREST AND THE ADJACENT FORMATIONS (BRITTANY). Michot, Jean; Deutsch, Sarah (Univ. Libre, Brussels). Eclogae Geol. Helv.; 63: 215-27(Apr 1970).

The Pb-U systems in zircons of detritic origin found in the nonmetamorphic Quartzophyllades de l'Elorn (France) are compared with those present in the corresponding Brioverian metamorphic formations of the Micaschistes du Conquet and the Gneiss de Brest. (auth) (France)

275 BEHAVIOR OF U-Th-Pb SYSTEMS IN THE UPPER MANTLE AND A MODEL OF THE EVOLUTION OF THE UPPER MANTLE THROUGHOUT GEOLOGIC TIMES. Allegre, Claude J. (Faculte des Sciences, Paris). Geochem. Int. (Engl. Transl.); 6: 1174-81(Oct 1970).

An examination of U-Th-Pb systems in the upper mantle is made utilizing a generalized version of the Concordia diagram. A continuous evolution model is derived in which the mantle acts as an open system due to continuous extractions of volcanic magmas. Consideration of data on young cogenetic volcanic suites shows that volcanogenesis generally involves fractionation of the U/Pb ratio and that the mantle has not acted as a closed system to these elements. The extraction of lead with respect to uranium appears to be higher in the source regions of alkali basalts than in the source regions of tholeiites. The model supports initial values of μ and Th/U of 8.65 and 3.7, and an age of the earth of at least 4.60 billion years. (auth)

276 RADIOACTIVITY OF MINERALS IN SOME ULTRABASIC ROCKS OF THE USSR. Cherdyntsev, V. V.; Senina, N. I.; Kuz'mina, E. A. (Geological Inst., Moscow). Geochem. Int. (Engl. Transl.); 6: 1109-12(Oct 1970).

Uranium, thorium-isotope (^{232}Th, Io, and RdTh), and plutonium contents are presented for 22 specimens of ultrabasic rocks of the USSR. The mean U content for the samples ranges from 0.01 to 0.1 ppM with a somewhat reduced Th:U ratio (average 2.5), which is ascribed to enrichment with uranium during metasomatism. Most of the uranium preparations contain a transuranium

α-emitter (4.4 to 4.7 MeV), probably a ^{239}Pu precursor, whose activity exceeds that of Pu (maximum content not greater than 2.9×10^{-11}%), which may be due to the position of the isotope on a secondary decay branch. Minerals often contain an excess of RdTh, a product of mesothorium (a Ra isotope), which has evidently been introduced by natural waters from surrounding rocks of higher activity. (auth)

Meteorology

Refer also to abstracts 258, 259, 295, 353, 463, 464, and 518.

277 (IDO–12073, pp 46-9) AIR RESOURCES LABORATORIES FIELD RESEARCH OFFICE, ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

The Air Resources Laboratories Field Research Office of the Environmental Science Services Administration sponsored the following activities during 1969: measurements to determine the detailed structure changes in low-level air flow across variable terrain and urban developments within the Los Angeles Basin; improvement of a computational method for analyzing wind station data from the Snake River Plain to obtain mesoscale air flow patterns in the near-surface atmosphere; studies of the transfer processes of radioiodine from air to grass; verification of 1965 to 1969 weather forecasts; study of wind fields in the Upper Snake River Valley; comparison of cup and hot wire anemometers as efficient sensors for atmospheric turbulence measurements; investigation of the effects of sampling time on the measurement of surface boundary layer turbulence; and experiments in the upper Snake River Plain area for studying the diffusion of intermittently released stack-disposed effluents from a chemical processing plant. Each activity is described briefly. (L.C.L.)

278 INVESTIGATIONS ON RADIOACTIVE FALL OUT. X. Stierstadt, K. (Univ., Munich). Atomkernenergie; 16: 153-4(197). (In German).

The results of artificial beta-activity measurements during the years 1967 to 1969 are presented, separately for rain and dust fallout. While the specific activity was approximately constant since the beginning of 1968, the accumulated activity remained nearly unaltered during the period 1968 and 1969. (auth)

279 AIRCRAFT MEASUREMENTS OF THE VERTICAL DISTRIBUTION OF RADON IN THE LOWER ATMOSPHERE. Bradley, Wayne E. (Illinois State Water Survey, Urbana); Pearson, John E. J. Geophys. Res.; 75: 5890-4(20 Oct 1970).

Radon-222 vertical soundings were made on five different days over Illinois from 150 meters to as high as 5 km above the surface. The Rn concentration ranged from 60 to 300 pCi m^{-3} at 150 meters above the surface and decreased exponentially by approximately one-half with every 700-meter increase in elevation. The Rn soundings were compared with earlier theoretical Rn profiles and with actual Rn measurements taken by several other investigators. The Rn concentration was found to decrease more rapidly with increasing altitude than had been calculated theoretically. Possible explanations for this disagreement are presented. (auth)

280 FALLOUT FROM THE CHINESE NUCLEAR EXPLOSION ON SEPTEMBER 29, 1969. Weinreich, R.; Krebs, E.; Wachner, K. (Univ., Mainz). Z. Naturforsch.; 25a: 1156-8(Jul 1970). (In German).

The analysis of fallout from the Chinese nuclear test of September 29, 1969, showed the typical features of a hydrogen bomb explosion. The fissionable material was probably ^{239}Pu combined with ^{238}U. However, the use of a combination of ^{235}U and ^{238}U employed in all earlier Chinese experiments cannot be excluded. (auth)

Mineralogy and Exploration

Refer also to abstracts 266, 474, and 793.

281 REFINEMENT OF THE CRYSTAL STRUCTURE OF HEAT-TREATED MONAZITE CRYSTAL. Ghouse, K. M. (Regional Research Lab., Hyderabad, India). Indian J. Pure Appl. Phys.; 6: 265-8(1968).

It is believed that the order of metamictization is reduced by the heat treatment of the crystal. Refinement of the crystal structure of monazite crystals heated at 1130°C for a sufficiently long period has been carried out using successive difference Fourier syntheses. It is concluded that the disorder in the lattice caused by α-particles from thorium is not rectified even after heating. From the sharpness of x-ray reflections obtained from the heated sample one could at the most say that in the process of heat treatment, some rearrangement of the structure is taking place. (auth)

282 CORRECTION METHOD FOR THERMALLY LOWERED FISSION TRACK AGES. Storzer, D.; Wagner, G. A. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Radiat. Eff.; 5: 129-31(Aug 1970).

To study track fading in glasses, one australite, one Libyan Desert glass, and one microscope slide were irradiated with thermal neutrons and then annealed for varying times between 100 and 650°C. After etching in 48% HF, the resulting track density was compared with that in unannealed samples. It was found that the track density decreases with annealing time and temperature, and that the activation energy of this effect increases with the degree of annealing. The diameter of the fission track etch pits also becomes smaller with annealing, and this effect may be used to correct fission track ages anomalously low due to partial annealing. Before annealing, the sizes of spontaneous and induced fission track etch pits are identical, but after annealing, the spontaneous ones are smaller than the induced ones. The method was used to correct thermally lowered fission track ages of tektites and related glasses, and to discover unusual thermal events. (D.L.C.)

283 LEXAN PLASTIC PRINTS: HOW ARE THEY FORMED? Kleeman, J. D.; Lovering, J. F. (Australian National Univ., Canberra). Radiat. Eff.; 5: 21-6(Aug 1970).

Lexan plastic prints are formed when a rock section is irradiated, with a sheet of plastic held against it, in a predominantly thermal neutron flux. The print texture is made up of varying densities of tiny etch pits, which are formed when the plastic is chemically etched after irradiation. The pits are formed from short trails caused by the passage of either α particles or recoil ions from the rock material. Observed pit densities are correlated with the mineral phases producing them, and calculations of the elemental concentration of B, Li, and O required to produce them are made. The present ideas of the print formation are compared with a previous suggestion that they are produced by recoiling OH ions. (auth)

Oceanography

Refer also to abstract 2.

Seismology

284 (AD–709735) SPECIAL AERIAL PHOTOGRAPHY NEAR THE NEVADA TEST SITE. Final Report. Slemmons, David B.; Brogan, George E.; Carver, Gary A.; Glass, Charles E.; McDonald, Robert L. (Nevada Univ., Reno. Mackay School of Mines). Jun 1970. 21p. (AFOSR–70–2035–TR). NTIS.

The project had two prime purposes: the first objective was to provide geologic and photogrammetric support to the United States Coast and Geodetic Survey, Lamont Geological Observatory, University of Nevada Seismological Laboratory and the Atomic Energy Commission for the Benham underground nuclear test. This support was in the form of large-scale aerial photography and aerial reconnaissance of their survey nets across active faults and any microearthquake arrays with post-test local activity. These photographs were then made available to these organizations or institutions upon request, for precise location and mapping of their nets and arrays; the second objective was to provide large-scale, low sun angle illumination photography of the highly active Winnemucca-Ventura Seismic Zone with special emphasis placed on the Owens Valley, Panamint Valley, Fish Lake Valley, Furnace Creek and Death Valley fault zones along with many other active fault zones located near, but not on the test site. This second objective was to provide "before" and, if necessary, "after" aerial photography and ground geological reconnaissance to determine whether any movement along these major active zones was the result of the Benham and other following nuclear tests. (auth) (USGRDR)

285 (AWRE-O-47/70) SOME SEISMIC RESULTS OF THE MILROW UNDERGROUND NUCLEAR EXPLOSION. Marshall, P. D.; Corbishley, D. J.; Gibbs, P. G. (Atomic Weapons Research Establishment, Aldermaston (England)). Aug 1970. 16p. Dep. NTIS (U. S. Sales Only). UK 2s. 6d.

Milrow, a large yield nuclear device, was detonated underground on Amchitka Island in the Aleutians and recorded at the four UKAEA sponsored arrays. The preliminary results from the four short period arrays and the analysis of the surface wave

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train from Milrow and from an earthquake in the Aleutian Isles recorded at Blacknest are presented. The JED technique for epicentre location and the results of spike filtering the short period signal to identify the free surface reflection pP waves are also presented. (auth)

286 (NVO–1163-195) SEISMIC SPECTRUM SCALING OF UNDERGROUND DETONATIONS. Mueller, Richard A.; Murphy, John R. (Environmental Research Corp., Las Vegas, Nev.). Mar 1970. Contract AT(29-2)-1163. 60p. Dep. NTIS.

A general scaling theory of ground motions resulting from underground nuclear detonations is developed from the solution of the wave equation with appropriate boundary conditions. The analysis shows that in addition to yield, the device depth of burial and the medium play a significant role in the scaling of seismic signals. The theory predicts an increase in the dominant frequency and ground accelerations with an increase of device depth of burial. This phenomenon is verified by observations from excavation events and overburied events. For events buried sufficiently deep for containment, the scaling theory predicts frequency dependent yield exponents (ranging from 0.90 at low frequencies to 0.45 at high frequencies) which are in good agreement with empirical relations statistically derived from a large number of events. (auth)

287 (NVO–1163-208) ELASTIC ENERGY AND MAGNITUDE DETERMINATIONS FOR UNDERGROUND DETONATIONS IN TUFF AND RHYOLITE. Murphy, John R.; Mueller, Richard A. (Environmental Research Corp., Alexandria, Va.). May 1970. Contract AT(29-2)-1163. 42p. Dep. NTIS.

An expression for the elastic energy produced by a contained underground nuclear detonation is derived using an analytic approximation for the pressure profile acting at the elastic radius. The resulting static strain energy and radiated energy equations are evaluated as a function of yield and depth of burial for detonations in tuff and rhyolite. It is shown that the elastic energy efficiency depends only on the depth of burial (h) and is proportional to $h^{0.72}$. Seismic spectrum scaling theory is applied to an analysis of the relationship between nuclear and earthquake seismic source functions, giving results which are in good agreement with the observed differences in the teleseismic magnitude determinations. A magnitude-energy equation is derived for underground nuclear detonations and is noted to be in poor agreement with the Gutenberg-Richter equation. A possible explanation for this discrepancy is presented which suggests that the radiated energy from small earthquakes may typically have been underestimated. (auth)

288 ASPECTS OF THE SPECTRAL DIFFERENCES BETWEEN EARTHQUAKES AND UNDERGROUND EXPLOSIONS. Marshall, P. D. Geophys. J. Roy. Astron. Soc.; 20: 397-416 (Sep 1970).

Methods for predicting Rayleigh wave amplitudes for explosions in different media, and how the amplitudes obtained in this way are used to obtain magnitudes are discussed. Rayleigh wave magnitudes are then compared with the magnitudes determined from the body wave predictions, and thus a magnitude relationship between surface and body waves is established for explosions. By comparing this relationship with that observed for earthquakes, an understanding is obtained for the spectral distribution of energy from earthquakes. This in turn leads to a better understanding of the unknown source function of an earthquake. The dependence of observed Rayleigh wave spectra from earthquakes and explosions on depth of focus and the source time function is also demonstrated, as well as the bearing of these analyses on the general problem of estimating seismic magnitudes. (auth) (UK)

289 ANALYSIS OF RAYLEIGH-WAVE MULTIPATH PROPAGATION AT LASA. Capon, Jack (Massachusetts Inst. of Tech., Lexington). Bull. Seismol. Soc. Amer.; 60: 1701-31(Oct 1970).

An investigation was made of the multipath propagation of Rayleigh waves by using data obtained from the large aperture seismic array (LASA). The use of the LASA in conjunction with a high-resolution analysis technique provides a greater angular resolution and accuracy than was previously possible for the analysis of the multipath propagation. Measurements have been made of this phenomenon for the Rayleigh waves of 26 events distributed at various azimuths and distances from LASA. On the basis of these measurements reasonably good conjectures are made concerning the actual propagation paths for groups in the 20- to 40-sec period range. It is shown that in almost all cases these propagation paths can be associated with refractions and reflections at the continental margins. (auth)

290 DISCRIMINATION OF EARTHQUAKES AND EXPLOSIONS BY THE RAYLEIGH-WAVE SPECTRAL RATIO. Derr, John S. (Massachusetts Inst. of Tech., Cambridge). Bull. Seismol. Soc. Amer.; 60: 1653-68(Oct 1970).

Limited data from a long-period vertical seismometer and the prototype of a new mercury tiltmeter at the station, Harvard, Massachusetts, tend to confirm that the Rayleigh-wave spectral ratio of short- to long-period energy provides a useful discriminant for underground explosions in the Western United States at distances of from 28° to 38° in the magnitude range of $3.5 < M_s < 5.6$. This corresponds to discrimination in the range of $5.0 < m_b < 6.3$. The same spectral ratio, however, does not discriminate the large Milrow event in the Aleutians from earthquakes in the same region, possibly because of differences in earthquakes source mechanisms in different regions and because this explosion released significant tectonic strain. The Rayleigh spectral ratio complements the $M_s - m_b$ discriminant by providing a clear separation of earthquakes and explosions in some geographical regions where earthquakes are of low stress drop and generally strike-slip in mechanism. (auth)

291 SYNTHESIS OF NONSTATIONARY SEISMIC SIGNALS. Beaudet, Paul R. (Environmental Research Corp., Las Vegas, Nev.). Contract AT(29-2)-1163. Bull. Seismol. Soc. Amer.; 60: 1615-24(Oct 1970).

Synthetic seismograms are a powerful tool which can be used to approximate the complex signature which an inhomogeneous, anisotropic, and imperfectly elastic Earth imparts to seismic waves generated by underground nuclear detonations. The concept and design of a time-varying analog filter for generating synthetic seismograms which approximate real seismograms observed from underground nuclear explosions have been developed. The basic design of this filter exploits a nonstationary characteristic commonly observed on seismograms, the gradual increase of period with time. The parameters of the time-varying analog filter were determined on the basis of the characteristics of the radial component of 50 seismograms recorded from underground nuclear detonations encompassing a wide range of yields (80 to 1000 kt) and distances (50 to 550 km) from the detonation. These parameters determine the time-varying response of the analog filter to a white noise input. The comparison of the spectra of synthetic and real seismograms indicates that the synthetic seismograms generated with the time-varying analog filter are close approximations to real seismograms having equivalent yield and range parameters. (auth)

292 EVENT IDENTIFICATION FOR TEST BAN CONTROL. Ericsson, Ulf A. (Research Inst. of National Defence, Stockholm). Bull. Seismol. Soc. Amer.; 60: 1521-46(Oct 1970).

A method for determining the usefulness of seismological event identification criteria for underground test ban control with or without on-site inspection is described. The method rests upon the notion that such control should be deterrent, by confronting a prospective violator with a certain disclosure probability at a politically determined level. Simple decision theory is then applied to the statistical properties of identification measures to find the required compromise between a sufficient probability to disclose explosions and a not too high incidence of false alarms about earthquakes. A clean separation between the political requirements and the seismological capabilities is obtained. The latter are expressed by identification curves similar to the receiver operating characteristic curves employed in telecommunications analysis. The political requirements appear as geometrical conditions on the identification curves, expressing the required deterrence, the number of yearly explosions and earthquakes to be considered and the permitted number and quality of inspections in the case of control with inspection. In the case of control without inspection, the acceptable rate of false alarms is included. The method also shows how identification criteria are most efficiently exploited. Application to some published observations shows identification by short-period body-wave magnitudes and long-period surface-wave magnitudes to be most efficient. It remains, however, to extend the analysis to weak events and low signal-to-noise ratios. For applications the acquisition of proper statistics is essential. (auth)

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Nuclear Explosions

Refer also to abstracts 284, 285, 287–289, and 291.

293 (AD-707122) THEORETICAL PREDICTION OF ACOUSTIC-GRAVITY PRESSURE WAVEFORMS GENERATED BY LARGE EXPLOSIONS IN THE ATMOSPHERE. Final Report, February 1, 1967–January 31, 1970. Pierce, Allan D.; Posey, Joe W. (Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering). 30 Apr 1970. Contract F19628-67-C-0217. 295p. (AFCRL-70-134). NTIS.

A computer program is described which enables one to compute the pressure waveform at a distant point following the detonation of a nuclear explosion in the atmosphere. The theoretical basis of the program and the numerical methods used in its formulation are explained; a deck listing and instructions for the program's operation are included. The primary limitation on the program's applicability to realistic situations is that the atmosphere is assumed to be perfectly stratified. However, the temperature and wind profiles may be arbitrarily specified. Numerical studies carried out by the program show some discrepancies with previous computations by Harkrider for the case of an atmosphere without winds. These discrepancies are analyzed and shown to be due to different formulations of the source model for a nuclear explosion. Other numerical studies explore the effects of various atmospheric parameters on the waveforms. In the remainder of the report, two alternate theoretical formulations of the problem are described. The first of these is based on the neglect of the vertical acceleration term in the equations of hydrodynamics and allows a solution by Cagniard's integral transform technique. The second is based on the hypothesis of propagation in a single guided mode and permits a study of the effects of departures from stratification on the waveforms. (auth) (USGRDR)

294 (AD-707440) SIMPLE TECHNIQUE TO DETERMINE THE SIZE DISTRIBUTION OF CRATER FALLBACK AND EJECTA. Final Report. Anderson II, Brooks D. (Army Engineer Nuclear Cratering Group, Livermore, Calif.). Mar 1970. 40p. (NCG-TR-18). NTIS.

Particle size distributions of fallback and ejecta have been determined principally by mechanical sieving and weighing. However, as the size of nuclear craters produced in the experimental program increased, it became increasingly more expensive to continue this procedure, particularly since the reliability of the data is proportional to the fraction of total available material investigated. An alternate technique to sieving and weighing involves the selection and measurement of particles lying beneath points along a selected line of traverse. A pebble count technique originated by Wolman (1954) has been modified and given theoretical justification (Delesse Relation) for generating a cumulative curve interpretable as a size-weight distribution. Data gathered to date indicate the results obtained are comparable to sieving and weighing the same material. Application of the technique to the DANNY BOY, CABRIOLET, BUGGY and Pre-SCHOONER ALPHA, BRAVO and CHARLIE Crater ejecta indicates the method can be successfully applied to both nuclear and chemical explosive crater fall back and ejecta. (auth) (USGRDR)

295 (AEC-tr-7100) GAMMA EMISSION OF RADIOACTIVE FALLOUT. Izrael', Yu. A.; Stukin, E. D. Translation of Gamma-Izluchenie Radioaktivnykh Vypadenii, Atomizdat, Moscow, 1967. 153p. (TT-70-50008; IPST-Cat.-5658). Dep. NTIS.

An attempt was made to consider in detail various questions related to the gamma emission of radioactive fallout. Data are presented on the gamma emission of radioactive products formed during nuclear explosions; the gamma-emission field in the fallout region is analyzed; the effects of natural conditions existing in this region (e.g., topography, underlying geology, vegetation) on this emission field are considered; and a study of radioactive contamination based on measurements of gamma-emission characteristics is discussed. (L.C.L.)

296 SPECTRAL ANGULAR DISTRIBUTIONS OF γ RADIATION FROM A NUCLEAR EXPLOSION. Goryachev, I. V.; Godovanik, B. K. This paper was summarized in At. Energy. (USSR); 25: 49(Jul 1968) as paper No. 215. (In Russian).

On the basis of published data on the angular distribution of air-scattered γ-radiation from a nuclear explosion, and the assumption that the probability density function of the distribution of explosion centers by azimuthal direction relative to the calculated positions is uniform, general characteristics of angular spectral distributions of γ-radiation from a nuclear explosion are developed. The angular distribution functions for air-scattered radiations from a nuclear explosion presented in generalized form permit a substantial reduction in the volume of calculations required for estimate of shielding of ground structures. As a result of the calculation the functions $F(\Omega, \beta, \Delta E_j)$ were tabulated. These functions characterize the fraction of the full dose from scattered radiation of a given component in energy intervals ΔE_j from 0.1 to 10 MeV, arriving in unit solid angle at a determined angle β measured from the normal to the earth's surface. Calculations were completed for the angle α over the range from 0 to 90° (α is the angle between the surface of the earth and the direction to the position of the explosion). (auth)

297 LABORATORY SCALE EXPERIMENTS INTO CAVITY AND CRATER FORMATION BY HIGH EXPLOSIVE CHARGES. Lynch, J. (Univ. of Manchester, Eng.) Hawkyard, J. B.; Johnson, W. J. Mech. Eng. Sci.; 12: 339-53(Oct 1970).

A Plasticine block was used to represent a semi-infinite solid, for the investigation of camouflet and crater formation by high explosive charges. The Plasticine model was 90 cm diameter and 60 cm deep and the explosive charges varied between about 0.1 g and 0.8 g, producing cavities and craters in the region of 2 cm to 5 cm radius. The shapes of the craters and cavities and the final surface contours were measured and compared with theoretical forms determined from a simple theory. Comparison was also made with the results of large scale nuclear and high explosive operations. (auth)(UK)

Facilities and Equipment

Refer also to abstracts 617, 1139, 1144, 1146–1152, 1701, and 1968.

298 (AAEC/E-208) SOME GEOMETRICAL PROPERTIES OF PACKINGS OF EQUAL SPHERES IN CYLINDRICAL VESSELS. PART I. EXPLORATORY STUDY OF RANDOM PACKINGS IN SMALL VESSELS. Tingate, G. A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1970. 36p. Dep. NTIS (U. S. Sales Only).

An experimental method is described for determining some of the mean geometrical properties of packings of equal spheres in cylindrical vessels. Essentially it involves determining the volumes of the sphere material in an outer region of thickness one sphere diameter, and the remaining central region. Related properties, including the mean void fractions of the two regions, can then be calculated. Since the properties of the central region of random packings prepared by a particular method are almost independent of the cylinder-to-sphere diameter ratio, it was possible to conduct exploratory experiments using small cylinders. The packings were prepared by a variety of methods. General expressions are given for calculating related properties from the observations and also for extending the results to larger vessels to an estimated accuracy of about ±2%. The accuracy of about ±1% inherent in the method may be achieved by refinements such as the use of vessels of larger diameter and the elimination of end effects. (auth) (Australia)

299 (DP-Report-114) THE ROLE OF IRRADIATION EXPERIMENTS IN A REACTOR DEVELOPMENT PROGRAMME. Project DRAGON. Shepherd, L. R. (Atomic Energy Establishment, Winfrith (England)). Oct 1962. 12p. (CONF-621105-1). Dep. NTIS.

From Meeting of the Swiss Nuclear Society, Zurich, Switzerland.

Various investigations in the development of a reactor system which requires the use of irradiation facilities are examined. Emphasis is placed on the Dragon irradiation program. Aspects of fission product diffusion in high temperature reactors require studies not needed in the development of lower temperature reactors. The purpose and philosophy of in-pile irradiation facility design are summarized. (J.R.D.)

300 (DP-Report-219) THE STEEL AND CONCRETE CONTAINMENT BUILDINGS FOR THE DRAGON REACTOR. Project DRAGON. Barrett, N. T. (United Kingdom Atomic Energy Authority, Risley (England). Engineering Group. Atomic Energy Establishment, Winfrith (England)). Oct 1963. 39p. (CONF-631012-1). Dep. NTIS.

From Dragon Project Engineering Symposium, Bournemouth, Eng.

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Containment buildings for the Dragon Reactor are described. A steel building surrounds all parts of the reactor in which fission products are found during operation. The steel building is surrounded by a concrete building maintained at sub-atmospheric pressure. (J.R.D.)

301 (DP-Report-221) ELECTRICAL ASPECTS OF THE DRAGON REACTOR. Project DRAGON. Edney, C. J. (United Kingdom Atomic Energy Authority, Risley (England). Reactor Group); Glover, T. J. (Atomic Energy Establishment, Winfrith (England)). Oct 1963. 24p. (CONF-631012-8). Dep. NTIS.

From Dragon Project Engineering Symposium, Bournemouth, Eng.

It is noted that there is no electric generation associated with the Dragon Reactor and that required electricity must be generated by conventional means on the site or obtained from sources external to the site. Descriptions are presented on the main electric supply to the Dragon site, on-site electric distribution, special power supplies, reactor cabling, and power supply to the 25-ton crane. (J.R.D.)

302 (DP-Report-224) HYSTERESIS CLUTCH DRIVE UNITS. Project DRAGON. Young, D. G. (Sperry Gyroscope Co. Ltd., Brentford (England). Atomic Energy Establishment, Winfrith (England)). Oct 1963. 24p. (CONF-631012-17). Dep. NTIS.

From Dragon Project Engineering Symposium, Bournemouth, Eng.

The development and testing of hysteresis clutch drive units for five different charge machine drives in the Dragon reactor are described. Two basic clutch designs evolved, one a 10 in. dia unit to produce 120 in-lb torque, the other a 6 in. dia clutch for a 25 in-lb torque, and with both capable of producing a signal during slipping. The results of dynamic and static locked output torque tests, dynamic output slipping torque tests, and measurements of the temperature rise in the hysteresis element during slipping are presented. It was concluded that: with either unit a warning signal can be produced when a clutch is slipping at speeds as low as 40 rpm; the static torque of the 6 in. unit was satisfactory; the static torque for the 10 in. unit was improved by reducing leakage and by concentrating the available flux in a smaller area of the hysteresis material; and the dynamic losses in both units were caused almost entirely by lubrication. A change to a lighter lubricant increased the synchronous torque appreciably. (L.C.L.)

303 (DP-Report-251) DEVELOPMENT WORK ON SEALS. Project DRAGON. Woodley, H. J. (Atomic Energy Establishment, Winfrith (England)). Dec 1963. 17p. (CONF-631012-16). Dep. NTIS.

From Dragon Project Engineering Symposium, Bournemouth, Eng.

Experimental work carried out to determine the effectiveness of various sealing systems proposed for use on the Dragon Project is discussed. Most of the systems were flange joints with metal seals, but various types of welds and elastomer seals were also tested. The general leak tightness requirements and testing methods are described. The results of tests on pipe couplings, intermediate and large size flange joints, heat exchanger and pressure vessel secondary seals, flanges with raised ridge sealing features, Conoseals, seal welds, and elastomers are presented. It is concluded that most of the sealing systems meet the leak tightness requirements, and that welded joints are superior to flanged joints in that they are not susceptible to temperature cycles. The importance of preventing damage to the seals and sealing surfaces during assembly of the joints is emphasized. (L.C.L.)

304 (EURFNR-819) KARLSRUHE SODIUM TANK TEST FACILITY. Huber, F.; Mueller, R. A. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung). Jul 1970. 13p. (KFK-1203). Dep. NTIS (U. S. Sales Only).

Work performed under United States-Euratom Fast Reactor Exchange Program.

The Sodium Tank Test Facility operated by the Institute of Reactor Development of the Karlsruhe Nuclear Research Center is described. This facility offers universal application allowing full scale and semi-technical scale studies of the many questions in the field of sodium technology. It consists of two vertical installed experimental tanks of 1 and 2 m diameter, respectively, the associated supply systems for sodium and cover gas, and a cover gas circulating system. The two experimental tanks are licensed for operating temperatures of 700 and 600°C, respectively. For experiments conducted at higher temperature, insert tanks, which can be heated separately, are installed into the experimental tanks; in this case, the experimental tanks serve as protective vessels only. The cover gas circulating system is designed to study the behavior of sodium aerosols in the cover gas and, if necessary, to provide purified and cooled cover gas for flushing and cooling. (auth)

305 (TID-4100(Suppl.60)) ENGINEERING MATERIALS LIST. Smith, Richard J.; Sachs, Francis L.; Clark, Willie E., (eds.) (Division of Technical Information Extension (AEC), Oak Ridge, Tenn.). Oct 1970. 28p. DTIE Free.

Four packages of engineering materials on the following devices are announced for inclusion in TID-4100: tritium monitor T446; tritium monitor display indicator T447; radiological urinalysis kit T449; and tritium monitor specifications. (L.C.L.)

306 APPARATUS FOR IRRADIATING ARTICLES MOVING ALONG A HELICAL TRACKWAY. Rogers, Frank (to United Kingdom Atomic Energy Authority). U. S. Patent 3,530,294. 22 Sep 1970. Priority date 26 Apr 1965, Great Britain.

Apparatus for irradiating articles with a source of radiation comprising a longitudinal member surrounded by guide structure which defines a helical trackway is described. At least part of the trackway is disposed within the field of radiation from the source. Means associated with the longitudinal member cooperate with the articles to be irradiated such that when the longitudinal member is rotated the articles are rolled along the trackway and are subjected to irradiation from the source. (auth)

307 IMPROVEMENTS RELATING TO THERMAL INSULATION. Bucknell, Ronald Ernest (to Whessoe Ltd.). British Patent 1,206,994. 30 Sep 1970. Filed 26 Mar 1968.

In some thermal insulation systems it is desirable to provide within the insulating layer sealing means that present a barrier to the movement of fluid through the insulation and thus prevent undue fluid flow as a result of thermal convection or pressure differences. The requirements for such seals are various and to some extent in conflict. Such seals should be as nearly as possible impervious to gas flow and the use of sliding joints is inadmissible. Accommodation must also be provided for differential thermal expansion, without change of shape and without throwing undesirable loads on adjacent components. In the system described the sealing means is composed of material impermeable to fluid flow and extending from the inner surface of the insulated vessel through the thickness of the insulation to a sheet on the internal face of the insulation layer. Corrugations are provided in the sealing means in such a direction as to accommodate relative thermal expansion of the regions of the sealing means adjacent to the vessel wall and to the interior face of the insulation layer. A number of different forms of seal are described. (UK)

308 COMPUTATION AND LAY-OUT OF STEAM GENERATORS IN NUCLEAR POWER PLANTS. Upmalis, A. Waerme; 76: No. 1-2, 1-8(1970). (In German).

Computational procedures, capacities, and types of steam generators for different reactor types in various countries are reviewed. (INIS)

309 STEAM TURBINE FOR NUCLEAR POWER GENERATION. Ninomiya, Satoshi (Hitachi Ltd., Ibaraki, Japan). Denki Hyoron; 55: 342-7(Feb 1970). (In Japanese).

The characteristic aspect of a steam turbine for nuclear power generation is that the steam condition is different from that of thermal power generation, and therefore the larger amount of steam flows through the turbine. The former presents some problem regardless of capacity, while the latter is mainly related to large capacity. In a nuclear turbine, the available energy of steam is smaller, namely, an increased amount of steam per unit power is required. The operation is in the wet range at all the stages. The problems are then concerned with long blades from the initial to the final stages, the inhibition of erosion, and the development of an effective moisture separator. Along this line, a steam turbine for nuclear power generation is described, e.g., the 138 MW turbine delivered to Pakistan and the 500 MW turbine being designed. (Japan)

310 TRENDS IN CIRCULATING PUMP DEVELOPMENT FOR NUCLEAR POWER PLANTS. Poetschke, H. Wasser, Luft Betr.; 14: No. 2, 52-4(1970). (In German).

The development of nuclear power plants has initiated a special requirement for water pumps for nuclear power plants. These pumps are absolutely reliable in operation. They have novel shaft seals for the high pressures and temperatures encountered. (auth) (INIS)

311 COLUMBIA FUEL MANUFACTURING PLANT. Smith, L. D. Nucl. Eng. Int.; 15: 817-21(Oct 1970).

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The plant will provide all Westinghouse's fuel requirements for light-water reactors. 10 to 15 complete cores and 30 to 40 replacement cores per yr will be manufactured. Descriptions are given of the preparation of UO_2 from UF_6 by the ADU process, fuel rod fabrication, spacer grids, sub-assemblies, and control rods. Notable features are clean-lines, efficiency and stringent quality control. (UK)

312 OPTIMUM PLANNING FOR RADIATION FACILITIES. MATERIAL AND PRODUCTION INSPECTION FACILITIES. Okajima, Nobuo (Taisei Construction Co. Ltd., Tokyo). Genshiryoku Kogyo; 16: No. 5, 17-23(May 1970). (In Japanese).

Optimal design of radioactive installations is outlined emphasizing material and product inspection facilities. Involved are radiation sources or radiation generators; stationary or non-stationary. There are no definite optimal designs since most designs depend on the circumstances. Significance of optimal designs, including specific classification of the involved parameters and the nature of optimal designs are described. Components of a radioactive facility such as the location and size of the laboratories are also described along with irradiation control, inspection, and treatment facilities. Location and configuration of the shielding is discussed including a formula for the particular shield required. Standards for radioactive facilities including radiation sources and radiation generators are outlined. (Japan)

313 GAS SEAL OF A NUCLEAR REACTOR CHANNEL. Ambroz, F.; Elger, R. (to SKODA Works). Czechoslovak Patent 131,651. 10 Jan 1969. Filed 10 Jul 1967. (In Czech).

The gas seal is formed by a tube provided on its internal periphery with grooves for concentric gear wheels with part of their periphery without teeth and another part with a plane area. In its base position the seal tube is sitting on an internal step of the channel. The fuel element is suspended on a rod having peripheric grooves of the same length as the tube. A body bearing the two gears is slipped on the rod above the fuel element. The gears fit with their teeth in the peripherical grooves of the rod. That part of the periphery of the gear wheels that is without teeth is of such length as to enable the whole gas seal mechanism to pass through the tube. The plane area of the gears forms a stop. (NSA of Czech.)

314 DYNAMIC THERMOELASTIC RESPONSE OF CYLINDRICAL SHELLS. McQuillen, E. J. (Naval Air Development Center, Johnsville, Pa.); Brull, M. A. J. Appl. Mech.; 37: 661-70(Sep 1970).

The dynamic, thermoelastic response of cylindrical shells to suddenly applied and rotating thermal inputs was investigated. Fully coupled, dynamic, thermoelastic cylindrical shell equations were derived using Galerkin's method. Identical results were obtained independently using a variational theorem. Analytical solutions to these equations were formulated for finite-length and infinite-length cylinders. Numerical results for the response of infinite-length cylindrical shells to suddenly applied and rotating longitudinal lines of heat flux are presented. It is shown that for many thermoelastic problems involving moving thermal inputs that the maximum ratio of dynamic to quasi-static deflection can be much greater than two, that dynamic effects can be important for all thicknesses within the realm of thin shell theory, and that semicoupled theory gives incorrect results in some cases for which a fully coupled theory is required. (auth)

315 NEW TESTING METHODS AND MEASURING EQUIPMENT FOR FUEL RODS IN NUCLEAR TECHNOLOGY. Zutz, L.; Wittekindt, U. (AEG-Telefunken Kernenergieversuchsanlage, Grosswelzheim, Ger.). Atompraxis; 16: 233-6(Jul-Aug 1970). (In German).

A measuring and testing machine for fuel element cladding tubes and fuel rods and a measuring device primarily intended for fuel pellets containing plutonium are described. Where applicable, the length, diameter, ovality and deflection of the objects can be measured with an accuracy of at least 1/100 mm. The documentation of all measured values takes place by means of a multi-channel recorder or an electronic digital read-out device. (auth)

316 POST IRRADIATION EXAMINATION FACILITIES AND TECHNIQUES. Campbell, D. (Atomic Energy Research Establishment, Harwell, Eng.). Nucl. Energy.; 11: 136-45(Sep-Oct 1970).

The reactor facilities at AERE are reviewed and the need for irradiation experiments stated. The health hazards of post irradiation examination are considered and the methods of protection listed. The design and use of glove boxes, remote handling equipment and shielding facilities are considered. The various handling facilities available at AERE are described including the High Activity Handling Building with the High and Medium Activity Handling lines and their associated transfer chambers, ventilation, lighting, windows, manipulating and heavy lifting equipment. (UK)

317 ACCURATE METHOD FOR DETERMINING THE APPARENT DENSITIES OF SMALL AMOUNTS OF SOLIDS AND ITS APPLICATION TO PYROLYTIC CARBONS. Cullis, C. F.; Norris, A. C.; Trimm, D. L. (Imperial Coll. of Science and Tech., London). J. Phys., E (London); 3: 911-13(Nov 1970).

An apparatus is described for the determination of the apparent densities of solids by a flotation technique. The method developed allows the density of about 0.001 g of sample to be measured to within ± 0.002 g cm^{-3}. (auth) (UK)

318 CORRELATION PARAMETERS FOR ELIMINATING THE EFFECT OF PULSE SHAPE ON DYNAMIC PLASTIC DEFORMATION. Youngdahl, C. K. (Argonne National Lab., Ill.). J. Appl. Mech.; 37: 744-52(Sep 1970).

The solutions to four classical problems in dynamic plasticity—the circular plate under uniform pressure, the reinforced circular cylindrical shell under uniform pressure, the free-free beam with a central concentrated force, and the circular cylindrical shell with a ring load—were examined to determine the effect of pulse shape on final plastic deformation. It was found that there is a strong dependence on pulse shape for pulses which have the same total impulse and maximum load; however, the effect of the pulse shape is virtually eliminated if the pulses have the same total impulse and "effective load." The "effective load" is defined as the impulse divided by twice the mean time of the pulse, where the mean time is the interval between the onset of plastic deformation and the centroid of the pulse. (auth)

319 EXAMINATION OF HIGH-TEMPERATURE AND HIGH-PRESSURE VALVES FOR NUCLEAR POWER GENERATION IN TERMS OF PLANT DESIGN. Tamai, Teruo (Tokyo Shibaura Electric Co. Ltd.). Haikan To Sochi; 10: No. 4, 17-20(Apr 1970). (In Japanese).

The nuclear power plants in Japan employ mainly BWR's and PWR's. The power-generating plant is the combination of a nuclear reactor and a turbine. The difference between conventional power plants and nuclear power plants is concerned with radioactivity. The protection of people, the deterioration of structural materials, multiple safety measures, and liquid sodium technology are major problems. In this connection, the high-temperature and high-pressure valves for nuclear power generation are reviewed as follows: valve design criteria for nuclear power plants; the performance of the valves for nuclear power plants, such as reactor-separation valves, liquid-sodium valves, and "explosion" valves; the prevention of low-temperature embrittlement of structural material; and design aspects for nuclear power generation. The ASME code for pumps and valves, and also the design concept in Japan, are described. (Japan)

Heat Transfer and Fluid Flow

Refer also to abstracts 298, 307, 308, 310, 314, 719, 1088, 1089, 1153, 1154, 1849, and 1897.

320 (AECL-3664) RESULTS OF TWO-PHASE BLOWDOWN EXPERIMENTS. PART I. STRAIGHT TUBE TEST SECTION. White, R. F. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Aug 1970. 73p. Dep. NTIS (U. S. Sales Only). AECL $2.00.

Experiments on the blowdown rig have yielded detailed information of the behavior of flowing two-phase steam–water mixtures during the first 100 ms after rupture of a diaphragm at the end of a pipe 15 feet long and 0.621 in. ID. Blowdown tests were made from initial pressures of 485 psia and 1002 psia and steam qualities from 8% to 31%. The mass flux was 158 lb/ft^2s and the two-phase flow pattern was annular, representative of conditions in a BLW reactor channel. Pressure transients measured at three positions about 7 feet apart in the test section showed that the transition from the pre-blowdown pressure gradient to that corresponding to critical discharge occurred in about 100 ms after rupture. Measured rarefaction wave velocities were in the range 1520 to 1570 ft/sec and all were within 6% of corresponding theoretical values. Measured masses of water discharged during the first 100 ms after diaphragm rupture agreed with values predicted by the homogeneous model for steady state two-phase critical flow, contrary to critical discharge rates measured under steady state conditions which agree with an annular two-phase critical flow model. (auth)

321 (AI-AEC-12939) EFFECTS OF VELOCITY, OXIDE LEVEL, AND FLOW TRANSIENTS ON BOILING INITIATION IN SODIUM. Logan, D.; Baroczy, C. J.; Landoni, J. A.; Morewitz,

H. A. (Atomic International, Canoga Park, Calif.). 28 Sep 1970. Contract AT(04-3)-701. 72p. Dep. NTIS.

Data are presented for incipient boiling superheat for sodium flowing upward in a 15- and 30-in.-long vertical annulus formed by a heated stainless-steel tube of ¼-in. dia located inside a ½-in.-diam tube. The data covered the following ranges: saturation pressure, 4.2 to 6.7 psia; liquid velocity, 1.6 to 9.4 lb/sec; heat flux, 0.11 to 0.77×10^6 Btu/hr-ft^2; inlet subcooling, 100 to 400°F; observed bulk superheat, −29 to +132°F. Comparisons of the observed superheats were made with the Laplace formula and the dynamic-superheat model. Specific directions for thermal effects were indicated by the all-liquid heat balance. Forced-convection boiling-inception wall superheats were well below predictions based on models and did not exceed 50°F at velocities greater than 5 ft/sec. (auth)

322 (CEA-CONF-1634) MEASUREMENTS OF FILM CONDENSATION HEAT TRANSFER COEFFICIENTS ON VERTICAL TUBES FOR NITROGEN, HYDROGEN, AND DEUTERIUM. Ewald, Rolf; Perroud, Paul (Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). [1970]. 21p. (CONF-700628-1). Dep. NTIS (U. S. Sales Only).
From Cryogenic Engineering Conference, Boulder, Colo.

Experiments carried out with a Frigoduc or cryogenic heat pipe (i.e., a device composed of a boiler connected to a condenser by a pipe through which a cryogenic fluid flows) have made possible the study of heat exchange phenomena at the condenser wall. The condensation surface is made of vertical smooth stainless steel tubes containing a cryogenic liquid boiling under constant pressure. On the external surface, vapor of the same fluid coming from the boiler (except for deuterium, where liquid hydrogen was used to condense the vapor) is condensed under a pressure depending on the exchanged thermal power. After a brief review on the techniques used, tables and curves for nitrogen, hydrogen and deuterium heat fluxes are presented as a function of the temperature variation at bulk saturation, as well as heat transfer coefficients. (auth) (France)

323 (EUR-4514) FORCED CONVECTION BURNOUT AND HYDRODYNAMIC INSTABILITY EXPERIMENTS FOR WATER AT HIGH PRESSURE. PART VII. BURNOUT HEAT FLUX MEASUREMENTS ON 3 x 3 ROD BUNDLES WITH NON-UNIFORM HEAT GENERATION. Campanile, A.; Galimi, G.; Goffi, M.; Passavanti, G. (Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari). 19 Jun 1970. 42p. Dep. NTIS (U. S. Sales Only). EUR Lit 750.-.

Burnout experiments conducted with high pressure water in 3 × 3 rod bundles characterized by singularities either in the geometry or in the heat generation are reported. Data are presented which concern the following experimental conditions: obstruction in the flow area, some nonuniform transversal heat flux distributions and a nonuniform heat generation in both transverse and axial directions. Whenever possible, the water temperature at several positions of the exit flow area of the channel was taken. Further, for each experiment the location of the burnout in the rod bundle was recorded. (auth)

324 (GEAP-10214) TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES. Quarterly Progress Report No. 18, January 1–March 31, 1970. (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). Apr 1970. Contract AT(03-4)-189. 52p. Dep. NTIS.

A conductivity probe was used in the circular tube test section for flow regime observations, and for film thickness determination in the annular regime. Results show no evidence of slug flow right at the end of the heated length; instead, there is an extensive transition between the bubbly and annular regimes. Slug flow was observed at 8 feet past the end of the heated length, at the two flows 0.5×10^6 and 1.0×10^6 lb/h-ft^2, over a limited range of qualities, but the evidence of slug flow vanished when the flow was increased to 1.5×10^6 lb/h-ft^2. In the range of parameters for the circular tube tests, slug flow occurs only under adiabatic conditions, and then only at the lower flows. A film thickness could be determined for qualities in excess of about 0.13. At $G = 0.5 \times 10^6$ lb/h-ft^2, the thickness for any particular quality changes very little with distance from the end of the heated length. At $G = 1 \times 10^6$ and 1.5×10^6 lb/h-ft^2, the film thickness is greater right at the end of the heated length than at 8 feet past, except when conditions are near CHF, in which case the film thickness is least right at the end of the heated length. At 8 feet past the end of the heated length and for qualities less than 0.18, the film thickness increases with increase in flow; for qualities greater than 0.22, the film thickness decreases with increase in flow. The trend in film thickness with flow rate right at the end of the heated length is essentially the same as at 8 feet past. Samples of film flow obtained with Setup No. 1 under nonisokinetic conditions show that the sample flow rate is not very sensitive to $P_w - P_c$, the difference in static pressure between the wall and the centerline (measured at the same axial position as the leading edge of the splitter). The two-phase multiplier determined from adiabatic two-phase pressure drop data is 25% to 35% below the Martinelli-Nelson value. (auth)

325 RADIAL TEMPERATURE DISTRIBUTION IN CYLINDERS HEATED BY INDUCTION IN EXPERIMENTAL INVESTIGATIONS OF LIQUID METAL SUPERHEATING. Riebold, W. (EURATOM, Ispra, Italy). Atomkernenergie; 16: 135-42(1970). (In German).

Analytical relations are presented which allow the determination of the temperature of superheats in experiments with stagnant liquid metals in stainless steel tubes which are heated by induction. To find a simplified mathematical solution for this problem asumptions have been made which reduce the two-dimensional transient heat conduction problem to a one-dimensional steady-state heat conduction problem and furthermore yield results which represent maximum values for the superheating temperature. (auth)

326 PROCEEDINGS OF THE THIRD AUSTRALASIAN CONFERENCE ON HYDRAULICS AND FLUID MECHANICS, SYDNEY, 25–29 NOVEMBER, 1968. Sydney; Institution of Engineers (1970). 254p. (CONF-681139).

Forty-seven papers were presented at the conference covering various engineering and physical applications of fluid systems. A separate abstract was prepared for each of two papers. The remaining papers were not within the scope of NSA. (Australia)

For abstracts of individual papers see: 327 and 328.

327 PACKED BEDS: THEIR DYNAMICS, STRUCTURE, FLUID FLOW, HEAT TRANSFER, AND OTHER CHARACTERISTICS. Szomanski, E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). pp 117-23 of Proceedings of the Third Australasian Conference on Hydraulics and Fluid Mechanics, Sydney, 25–29 November, 1968. Sydney; Institution of Engineers (1970).
See CONF-681139.

Progress made in the understanding of many packed bed characteristics is discussed with particular reference to the Australian Atomic Energy Commission's feasibility study of a pebble bed nuclear reactor. Attention is paid to beds formed from circulating smooth spherical particles in cylindrical vessels with conical hoppers. Findings include isolation of characteristic zones in the pebble flow, which appears to be essentially a steady state phenomenon. The new experimental information underlines limitations of the fluid analogy as the basis of analysis of pebble flow and packed bed wall pressures. There is a difference in behavior of the wall region to that of the central region. The latter appears more homogeneous than it was considered hitherto. In general, study of the heat transfer and fluid flow characteristics supports findings on the structure and dynamics of randomly packed beds. (auth) (Australia)

328 MODEL STUDIES OF THE COOLING WATER SYSTEM FOR A NUCLEAR POWER STATION. Donovan, J. R.; Painter, A. (British Hydromechanics Research Association, Cranfield, Eng.). pp 186-92 of Proceedings of the Third Australasian Conference on Hydraulics and Fluid Mechanics, Sydney, 25–29 November, 1968. Sydney; Institution of Engineers (1970).
See CONF-681139.

The hydraulic characteristics of the design of the cooling water system of the Dungeness B Nuclear Power Station are described, with suggested application to all conventional thermal power stations. Investigations carried out were concerned with the cooling water pump house, the cooling water pump discharge manifold and cross over, the inlet and outlet culverts of the condensers, and the siphon recovery chamber. (Australia)

329 EXPERIMENTAL INVESTIGATION OF THE NATURAL CONVECTION OF A HEAT-GENERATING FLUID WITHIN A CLOSED VERTICAL CYLINDER. Murgatroyd, W. (Imperial Coll. of Science and Tech., London); Watson, A. J. Mech. Eng. Sci.; 12: 354-63(1970).

Experimental results are presented of the velocity and temperature distributions within a heat-generating fluid contained in a vertical closed cylinder, for the case in which the outer surface of the cylinder wall is maintained at a uniform temperature. Previous experimental data are compared and an earlier theoretical model for a different thermal boundary condition is reinterpreted for the present case. (auth) (UK)

Isotope Technology

Refer also to abstracts 140, 180, 186, 262, and 342.

330 (MLM-1757) LIFE SUPPORT II PROGRAM. Final Report. Davis, N. E.; Johnson, E. W. (Mound Lab., Miamisburg, Ohio). 28 Oct 1970. Contract AT-33-1-GEN-53. 50p. Dep. NTIS.

Five radioisotope-powered heat sources fueled with $^{238}PuO_2$ microspheres were fabricated at Mound Laboratory for use in the Life Support II Program. Four of the heat sources had a thermal power of 73.5 W each, and the fifth source had a thermal power of 48 W. These heat sources provided energy for operating the Life Support II water reclamation system. This system was satisfactorily operated for approximately 70 days total test time. The system, including the five heat sources, will be operating during the 90-day manned chamber tests in the Space Station Simulator at McDonnell-Douglas, Huntington Beach, California. (auth)

331 (ORNL-IIC-30(Pt.2)) SELECTED ABSTRACTS OF WORLD LITERATURE ON PRODUCTION AND INDUSTRIAL USES OF RADIOISOTOPES (FROM NSA, APRIL-JUNE 1970). Gerrard, Martha; Baker, P. S. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 64p. Dep. NTIS.

Approximately 540 abstracts of domestic and foreign publications on production and use of radioisotopes and radiation, selected from the April-June 1970 issues of Nuclear Science Abstracts, are presented. (auth)

332 (SC-DR-70-560) PIONEER RTG HEAT SOURCE DROP TESTS. Entrekin, J. L. (Sandia Labs., Albuquerque, N. Mex.). Aug 1970. 126p. Dep. NTIS.

Eighteen simulated pioneer heat sources representing four different heat source shapes were drop-tested at Tonopah Test Range to obtain terminal velocity data and reduced trajectory data. A secondary objective was the acquisition of data related to impact crater and soil characteristics. Photographs of the samples before impact and reduced trajectory data are presented (auth)

333 (WANL-3800-46) [SNAP-23A PROJECT]. Phase 1 Final Report, December 1, 1969-February 28, 1970. (Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.). Sep 1970. Contract AT(30-1)-3800. 101p. (WANL-TR-(SS)-6). Dep. NTIS.

A summary is presented of the SNAP-23A Program from its inception to the conclusion of Phase 1. The reorientation of the program based on successful developments is indicated. Testing of the first mockup system, EMS, demonstrated that the SNAP-23A performance objectives had essentially been met, therefore, the program proceeded directly to the design, fabrication, and testing of the fueled prototype mockup system, FPMS. Accomplishments include in excess of 12,500 hours total test time on the EMS with no change in system performance; an extensive materials test program was completed which confirms and supports materials chosen for the basic SNAP-23A design; an extensive component test program was completed. In particular this program qualified the converter, power conditioner, radiator, fuel capsule, and shield for their intended use; shock and vibration testing of the EMS system was successfully completed and demonstrated compliance with MIL-STD-810A as required for this program; fueling of the FPMS system was completed and performance testing is underway. Required facility and heat source transportation licenses were obtained; safety analyses documented that the FPMS design is in accord with the safety criteria established for the SNAP-23A Program; and system studies showed that the 60 watt(e) technology, system and converter, is applicable to systems in the power range of from 25 to 100 watt(e). A narrative history of the SNAP-23A program is included. A test summary covering component, materials, and system tests is also presented. The scope of each completed test is presented and appropriate references identified for detail information. A comprehensive summary of EMS and FPMS performance during Phase 1 is also presented. (auth)

334 APPLICATION OF RADIOISOTOPES FOR THE DEVELOPMENT OF ROLLER AND BALL BEARINGS. Salt, D. (Rolls-Royce Ltd., Derby, Eng.). Z. Wirt. Fertigung; 65: 228-30(May 1970). (In German).

An arrangement is described for the detection of bearing wear in a normal gas turbine transmission under dynamic conditions. One of the balls or rollers is activated (^{59}Fe) or a small radioactive sample (hollow needle of ^{60}Co or ^{192}Ir) is inserted into the bearing cage. The speed of revolution of the bearing cage is then measured and the amount of slippage is determined. Block diagrams of the basic tachometer system and the electronic scheme of the isotope tachometer are presented. (INIS)

335 COBALT-RHENIUM ENERGY SOURCE. Rhines, Frederick N.; Donovan, James A.; McDonell, William R. (to United States Atomic Energy Commission). U. S. Patent 3,527,948. 8 Sep 1970. Filed 10 Dec 1968.

A high-temperature cobalt-rhenium radioactive energy source is prepared by placing alternate layers of porous rhenium and radioactive cobalt metal into a capsule and heating the capsule and layers above the melting point of cobalt to infuse the molten cobalt into the rhenium layers without substantial diffusion of the cobalt into the capsule walls. (auth)

336 METHOD FOR MEASURING QUANTITIES ASSOCIATED WITH THE FILLER DISTRIBUTION OF PAPER. Lehtinen, Antti Ilmari; Kuusi, Eino Juhani (to Valmet Oy). U. S. Patent 3,530,296. 22 Sep 1970. Priority date 1 Apr 1967, Finland.

Coatings and fillers in paper are measured without destroying the paper by a radioisotope radiation source, alpha radiation being used for measuring the coating substance and the filler contents of the surface layers of paper, while x-ray, gamma, or beta radiation is used for measuring the total filler contents in the direction of paper's thickness. (auth)

337 ISOTOPE SEPARATION BY NOZZLE METHOD. Droscha, H. Industriekurier; 23: No. 81, 17(1970). (In German).

Brief description is given of principles of the gaseous diffusion method, gas centrifuge method, and nozzle method for enrichment of ^{235}U using UF_6. (INIS)

338 DEPRECIATION COSTS OF RADIATION SOURCES IN INDUSTRY. Azzam, Reda A. I. (Atomic Energy Establishment, Cairo). Atompraxis; 16: 246-7(Jul-Aug 1970).

The use of radiation sources has recently extended to almost all the industrial processes. The conventional methods of costing have failed to calculate the depreciation costs of such sources. Three equations for calculating the book-value, depreciation costs and the rates of depreciation of the price of the radiation sources are suggested. Examples treated in the text have given a satisfactory relationship between the costing variables of the price, the physical decay of the sources and the economy of their use in industry. (auth)

339 SIMPLE METHOD FOR PRODUCING LINE RADIOACTIVE SOURCES. Galbraith, I. A. (Univ. of Glasgow). Nucl. Instrum. Methods; 86: 325(1970).

A method is outlined for concentrating radioactive material into a narrow rectangle, i.e., for forming a "line" source. (auth)

Materials Testing

Refer also to abstracts 314, 628, and 663.

340 (BNWL-1349-2, pp 8.1-8) NONDESTRUCTIVE TESTING. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

The technique has been further explored of using the multiparameter eddy current test to discriminate against signals caused by simulated tube supports. It has now been shown that the signals from three different simulated tube supports can be discriminated against by using one set of calibration adjustments. An analysis of complex plane diagrams of the 4-dimensional signals from two simulated tube supports and a region of suspected intergranular corrosion in the tube confirms the observed discrimination. Development continued on a new ultrasonic transducer for extended operation in liquid sodium at temperatures above 1200°F. High temperature electrode bonding techniques were developed, and one developmental unit was successfully fabricated. This unit was tested at room temperature and showed both transmit and receive response after having been heated to approximately 2000°F. The piezoelectric characteristics of four lithium niobate crystals were measured at intervals as the gamma radiation dose was increased to 10^{10}R. No detectable change could be measured in the piezoelectric coupling factor dielectric constant, or frequency constant. These data add additional support to the use of lithium niobate in high temperature ultrasonic transducers for in-reactor use. Thermal image transducers with limited response up to 30 Hz were fabricated. Tests showed that further improvement in the response is needed before the transducers can be applied to practical detection of unbonds under thin coatings. The phosphor darkening problem encountered last quarter in water-cooled transducers was eliminated, but a new problem, believed to be due to corrosion of the transducer foil, showed up during extended testing. Further development of the high frequency and water-cooled

thermal image transducers is underway. A comparison of a Moessbauer through-transmission geometry to backscatter geometry showed the latter to have a larger percent effect, and therefore an advantage in counting time. (auth)

341 (BNWL-1406) APPROACH TO MULTIPARAMETRIC EDDY CURRENT NONDESTRUCTIVE TESTING USING PULSE TYPE WAVEFORMS. Barman, I. L. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Sep 1970. Contract AT(45-1)-1830. 21p. Dep. NTIS.

The vector space concept as applied to the identification of test specimen parameters in nondestructive tests is reviewed. The analysis of the response of an exciting coil encircling a metal cylinder to a step function driving current is made to gain insight into the use of such a signal in an eddy current nondestructive test. A closed form approximate expression for this response function is obtained by starting with the classical series solution for this cylindrical case and applying the Euler–McLaurin summation formula. The closed form approximation was checked experimentally using a coil encircling a stainless steel bar, and the measured and calculated results agreed within explainable experimental error. The principles of orthogonal filters are reviewed and their application to the analysis of the test coil response function is discussed. (auth)

342 (KURRI-TR-58) NONDESTRUCTIVE TESTING. Tsujimoto, Tadashi (ed.) (Kyoto Univ. (Japan). Research Reactor Inst.). 1969. 35p. (In Japanese). (CONF-681140). Dep. NTIS (U. S. Sales Only).

A series of five papers, presented at the 4th Research Conference on Nondestructive Testing held at the Research Reactor Institute of Kyoto University on November 19, 1968, is listed. The subjects discussed include the use of ^{192}Ir to determine scale formation in pipes by transmission photography; a γ-radiation level detection unit; use of ^{192}Ir for the nondestructive tests of jet engines; the use of ^{60}Co to determine the erosion of the brick lining of steel furnaces; and the use of ^{60}Co to inspect the condition of welded joints in the rails of newly-laid National Railway lines. The unique advantages presented by the nondestructive approach in these examples are cited. (TTT)

343 (RD/B/N-1668) STEADY STATE CREEP TEST OF NOZZLE/SPHERICAL SHELL INTERSECTIONS. PART 1. TEST RIG AND INSTRUMENTATION. Procter, E.; Strong, J. T. (Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.). May 1970. 21p. Dep. NTIS (U. S. Sales Only).

The experimental techniques used to complete a steady-state creep test on a model pressure vessel containing four nozzles in a spherical cap are described. This is the third and final test in an experimental research program designed to investigate the behavior of nozzle/spherical shell intersections. The model pressure vessel was subjected to an internal pressure of 485 psig and a temperature of 430°C for 3000 hr, and the accumulation of creep strain in the shell plate and local to the nozzles was measured. The heating, pressurization, and control equipment and the methods of strain measurement are described and discussed. (auth) (UK)

344 (RHEL/R-202) LOW TEMPERATURE MATERIALS TEST RIG AND SOME TYPICAL DATA. Middleton, A. J. (Rutherford High Energy Lab., Chilton (England)). May 1970. 18p. Dep. NTIS (U. S. Sales Only). UK 3s. 6d.

A machine for testing engineering materials at low temperature is described and some tensile, compression, thermal contraction, and electric resistivity data at 77K and 4.2K are listed. (auth) (UK)

345 (WAPD-TM-926) DUZ-2: PROGRAM FOR SOLVING AXISYMMETRIC AND PLANE ELASTIC-PLASTIC PROBLEMS ON THE CDC-6600 (LWBR Development Program). Friedrich, C. M.; Guillinger, W. H.; Hageman, L. A.; Jeffrey, C.; Peterson, W. D. (Bettis Atomic Power Lab., Pittsburgh, Pa.). Sep 1970. Contract AT-11-1-GEN-14. 199p. Dep. NTIS.

DUZ-2 is a digital computer program for solving inelastic two-dimensional plane and axially symmetric problems. Loading conditions may arise from nonuniform temperatures, body forces, and boundary displacements or forces. Bodies may be nonhomogeneous, and all material properties may be temperature-dependent. Inelastic stress-strain relations may be expressed by piecewise linear curves or by power fits. Up to 5000 mesh points are allowed, with variable mesh and diagonal boundaries. (auth)

346 (WAPD-TM-956) A METHOD OF ANALYSIS FOR THE CREEP-BUCKLING OF TUBES UNDER EXTERNAL PRESSURE (LWBR Development Program). Wilson, W. K. (Bettis Atomic Power Lab., Pittsburgh, Pa.). Oct 1970. Contract AT-11-1-GEN-14. 58p. Dep. NTIS.

A numerical method for the creep-buckling analysis of long circular cylinders which are initially out-of-round and subjected to uniform external pressure is presented. The method eliminates the need for many of the major assumptions previously used and can handle any combination of either strain hardening or time hardening and either the Mises flow rule or the Tresca flow rule. A computer program written to carry out the steps of the numerical method is described. A number of specific cases are studied and the results indicate that the calculated buckling times are highly dependent on the hardening law and the flow rule used. (auth)

347 PULSED EDDY CURRENT INSPECTION OF THIN-WALLED REACTOR FUEL TUBING. Busse, T. H.; Beyer, N. S. (Argonne National Lab., Ill.). Mater. Eval.; 28: 228-36(Oct 1970).

Inspection of approximately 137,000 feet of EBR-II fuel jacket tubing conducted nondestructively using eddy current techniques is described. Although a complete description of the inspection equipment is included, emphasis is placed on various techniques in application of existing instrumentation to the inspection problem. Production details as well as the results obtained through the use of these techniques are included. The object of the inspection itself is to eliminate all tubing which might prove detrimental when used for jacketing in the assembly of EBR-II fuel pins. Quality requirements specify that wall defects or localized reduction of wall thickness equal to or greater than 10 per cent of the wall thickness are cause for rejection. (auth)

348 SOME APPLICATIONS OF FIXATION OF PHOTOELASTIC-FRINGE PATTERNS BY GAMMA RAYS [FOR STRESS ANALYSIS]. Miyazono, Shohachiro. Exp. Mech.; 9: 473-7 (Oct 1969).

Two previous papers described how the photoelastic-fringe patterns were fixed by γ-ray irradiation and how the residual-fringe patterns were influenced by the weight ratio of epoxy resin to curing reagent and radiation dose. How this method may be applied to several two and three-dimensional problems is described. The two-dimensional problems are: a straight beam subjected to pure bending; a semiinfinite plate under a normal concentrated load; and a bar with a central circular hole subjected to pure tension. The three-dimensional problem is a circular shaft with a transverse hole where the results are compared with results from the conventional stress-freezing method. (Metals Abstr.)

349 FUNDAMENTAL ASPECTS OF GAMMA RAY MULTI LAYER RADIOGRAPHY. Chae, Wha Mook (Office of Atomic Energy, Seoul); Nojiri, Toshiaki; Aonuma, Keisuke. J. Nucl. Sci. (Seoul); 10: No. 1, Pt. 1, 45-51(Jun 1970). (In Korean).

The industrial use of the multi-layer radiography is herein proposed. The multi-layer graphic film connected to the object is to give its overall image by forming 3-dimensional layers. The size of obscurity relating to each rotation angle, i.e., 90°, 44°, etc. can be measured from the tomographic methods. (auth)

350 BASIC RADIOGRAPHY: 11-DENSE METAL CASTINGS. Noden, D. F. (David Brown Gear Industries Ltd., Sheffield, Eng.). Non-Destruct. Test.; 3: 351-6(Oct 1970).

The preparation of the specimen; factors influencing its radiographic coverage; angles of view; number of aspects and exposures required; the selection of exposure conditions; double film techniques; the control of radiograph quality; and factors influencing the preparation of radiological techniques, are described. A brief summary of the place of high energy x-ray sources and multi-curie sources is given. (auth) (UK)

351 FRACTURE MECHANICS AS A TOOL FOR UNDERSTANDING STRENGTH BEHAVIOR. Blauel, H. J. G.; Kalthoff, J. F.; Sommer, E. (Angewandte Forschung eV, Freiburg i. B.). Materialpruefung; 12: No. 3, 69-76(1970). (In German).

Starting from the stress distribution around a single crack, characteristic numbers are introduced which describe the resistance of a material to crack propagation. These numbers characterize the material strength more accurately than the tensile strength or the transition temperature, since they are more directly related to the physical parameters involved. Such numbers are critical values of the stress intensity factor K or the crack extension force G. The equivalence of K- and G-values can be shown. Tests for the determination of K_c- or G_c-values have been developed in the USA. These tests are commonly applied in American industry for the characterization of the strength of materials (used mainly in aircraft production, ship building, and reactor construction). Descriptions of these tests are given along with typical experimental conditions. (INIS)

352 SOME MEASUREMENTS OF THE RESOLVING POWER OF THE INTENSIFYING SCREENS USED FOR RADIOGRAPHY

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WITH BEAMS OF THERMAL NEUTRONS. Hawkesworth, M. R.; Raoof, M. A. (Univ. of Birmingham, Eng.). J. Phys., E (London); 3: 851-4(Nov 1970).

Measurements of the resolving power of examples of the NE421 (0.65 mm granular), NE905 (1.3 mm glass) and gadolinium (25 μm metal foil) intensifying screens used in thermal neutron radiography are presented. The observations were made on images of a gadolinium knife-edge object using a microdensitometer with a recently developed digitized output. This is described along with the image analysis techniques used as they may be useful in other fields. Conventional unsharpness figures were obtained using two alternative measurement criteria which give somewhat different values; the popular method due to Klasens giving: NE421, approximately 1100 μm; NE905, approximately 450 μm; Gd foil, approximately 70 μm. The contrast transfer function of each screen in conjunction with Ilford HP3 film was also determined. The spatial frequencies at which the contrast of the image falls to 10% of that produced by an extended object of the same thickness are: NE421, 2.3 ± 0.4 cycles mm^{-1}; NE905, 5.1 ± 0.8 cycles mm^{-1}; Gd foil, 9.7 ± 0.6 cycles mm^{-1}. Finally the transfer functions of a series of experimental screens are presented together to demonstrate the value of the techniques used to component development. (auth) (UK)

Protective Structures

353 (AD-706853) TERF MONTE CARLO FALLOUT CODE CALCULATIONS. Final Report, April 15, 1969-April 30, 1970. Cohen, M. O. (Mathematical Applications Group, Inc., White Plains, N. Y.). Contract DAHC20-70-C-0205. 67p. (MR-7002). NTIS.

TERF is a three-dimensional Monte Carlo radiation transport code for computing gamma-ray dose due to fallout on complex structures and nonuniform terrain. The code was employed to solve a wide range of fallout and shielding problems to demonstrate its accuracy and its applicability for solving various types of problems often encountered in Civil Defense programs. (auth) (USGRDR)

Radioactive Material Handling

Refer also to abstracts 1, 38, 155, 252, 258-260, 316, 364, and 518.

354 (BNWL-1425) WASTE SOLIDIFICATION DEMONSTRATION PROGRAM. EXPERIMENTAL TECHNIQUES FOR CHARACTERIZATION OF HIGH-LEVEL RADIOACTIVE SOLIDIFIED WASTE. Thompson, R. J.; Mendel, J. E.; Hampton, C. Jr.; Irby, H. H. Sr.; Kleinpeter, J. H. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jun 1970. Contract AT(45-1)-1830. 75p. Dep. NTIS.

The Waste Solidification Demonstration Program is a cooperative program for the Atomic Energy Commission involving the Pacific Northwest Laboratory, the Brookhaven National Laboratory, and the Oak Ridge National Laboratory. The overall objective of the program is to provide the technological bases which will enable industry to convert the high-level liquid waste from the reprocessing of nuclear fuel to a safer solid form. The work has culminated in the operation of the Waste Solidification Engineering Prototypes by Battelle-Northwest, wherein engineering-scale radioactive demonstrations are being conducted with three alternative solidification systems: phosphate glass, spray solidification, and pot calcination. Basic objectives of the program are to determine the characteristics of the solidified waste products and evaluate the safety and economic aspects of the product characteristics as related to the management of high level radioactive wastes. Significant development efforts were required to establish many of the measurement techniques that would allow the solidified waste and waste container to be evaluated and characterized. Techniques are discussed for applying radioactive and nonradioactive measurements to measure leachability, thermal diffusivity, heat capacity, density, drip point, thermal shock, container wall thickness, dispersibility, crystallinity, linear coefficient of expansion, container dimensions, gross gamma measurements, temperature distribution in large containers, calorimetry, leak checking, and pot sealing by welding. The techniques used to measure characteristics of solidified wastes from the Waste Solidification Demonstration Program are described in detail. (auth)

355 (GA-10272) APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS. Project Summary Report, July 1, 1969-June 30, 1970. Bramblett, R. L.; Ginaven, R. O.; Gozani, T.; Hyde, A. T.; Kull, L. A.; McMillan, J. I.; Rundquist, D. E.; Trimble, G. D. (Gulf Radiation Technology, San Diego, Calif.). 31 Jul 1970. Contract AT(04-3)-167. 133p. Dep. NTIS.

Work performed on the development of techniques and equipment for nondestructive measurement of nuclear materials in various forms such as those encountered in the fabrication and reprocessing of reactor fuel is described. The nondestructive assay methods studied are summarized. The radioactive neutron source method was used for an assay system constructed for United Nuclear Corporation. The reactor methods have been offered as a commercial service. Several techniques are being developed which use sub-MeV neutrons as the source for active interrogation. Three of these techniques are described; two of them using a Linac as a neutron source and one using a radioactive source (antimony-beryllium). These techniques are particularly useful for measuring small amounts of fissile material (^{235}U, ^{239}Pu, ^{233}U) in the presence of relatively large amounts of fertile materials (e.g., ^{238}U, ^{232}Th). Most of the techniques being developed are based on the use of an electron linear accelerator (Linac) as a source of radiation for active interrogation of samples. Electrons at energies between 5 and 10 MeV from a Linac are used to produce a bremsstrahlung beam which irradiates the sample, producing characteristic nuclear reactions (photofission and (γ,n)) in the nuclear material present. Detectors are used to measure the resulting reaction products which include prompt neutrons, delayed neutrons and gamma rays from fission products. The intensities of these reaction products indicate the amount and type of nuclear material within the sample. Measurements of the bremsstrahlung induced neutron yields from ^{235}U, ^{238}U, ^{239}Pu and ^{232}Th are presented. Results of measurements of fission product gamma rays following the bremsstrahlung irradiation of the same four isotopes are presented. The most important advantages of nondestructive assays exist for the case of large inhomogenous samples such as barrels of nuclear scrap. For these samples, it may be impossible to obtain a small representative sample for destructive analysis. If the entire barrel can be interrogated in such a way as to produce uniform response from the nuclear material present, the sampling problem can be overcome. The use of photoinduced reactions is very promising from this point of view. One reason is that the high energy bremsstrahlung used to interrogate the sample is very penetrating, especially for typical samples containing low atomic number materials like paper, plastic, carbon, aluminum, or iron. In addition, the bremsstrahlung is easily collimated into a beam which can be used to scan large samples in such a way as to reduce attenuation effects and obtain uniform response. Significant progress has been made in developing both the hardware and techniques for barrel scanning. A description of the barrel scanning system as well as some recent results including an assay of eight 5-gallon drums containing uranium dispersed in silicon carbide grit are given. As a means of demonstrating the versatility of an electron accelerator for the nondestructive assay of nuclear materials, construction was started on a prototype transportable assay system. All major components have been individually tested and installation in the trailer is under way. Field tests of the entire system are scheduled. Details of the transportable system are presented. (auth)

356 (LA-4523) NUCLEAR SAFEGUARDS RESEARCH AND DEVELOPMENT. Program Status Report, May-August 1970. (Los Alamos Scientific Lab., N. Mex.). Sep 1970. Contract W-7405-eng-36. 34p. Dep. NTIS.

Equipment and methods for the neutron interrogation and nondestructive analysis of fissionable materials are described. Results of tests on one-gallon recovery cans of Pu scrap are given. Information is presented on radioactive neutron sources for nondestructive assay applications; delayed neutron yield versus energy measurements; passive neutron and gamma-ray assay of prototype LMFBR fuels; detector and instrumentation development; computational and data acquisition facilities; and mobile nondestructive assay laboratory. (R.C.K.)

357 (ORNL-TM-3170) STATUS OF PRESSURIZED AQUEOUS COMBUSTION FOR BURNING SOLID WASTES CONTAMINATED BY RADIONUCLIDES. Clark, Walter E. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 22p. Dep. NTIS.

A literature survey and initial experiments were performed to define the applicability of the Pressurized Aqueous Combustion (PAC) process for burning solid wastes which are contaminated with radionuclides. The survey indicated that much of the commercial technology for burning sewage and solid municipal wastes under water using the ZIMPRO process (also called wet air oxidation or pressurized aqueous combustion) is directly applicable to radioactive solid wastes. PAC offers potential advantages over conventional incineration including: simplified problems in cleaning the off-gas and containment of plutonium; operation at lower

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temperatures; reduced corrosion problems; close control of gas input and minimization of off-gas volume; and the use of continuous or batch systems. Operation under pressure in a closed system may be an advantage rather than a disadvantage since the equipment isolates the plutonium. The residual liquid effluent can be combined with other liquid wastes for solidification and disposal or can be processed to recover valuable isotopes. In initial nonradioactive batch tests with slurries containing 9 wt % solids at 193 to 222°C and 1190 to 1550 psi, 66 to 89% of the cellulosic wastes (paper, wood, cloth) were oxidized in 1 hr. The gaseous effluent was primarily carbon dioxide with a trace of carbon monoxide. The liquid effluent contained ash and soluble organic materials, primarily acetic acid. Essentially complete oxidation was obtained in shorter operating times at higher temperatures (e.g., 250 to 294°C. Recycle of the effluent catalyzes the oxidation of the next batch. Silica gel and heavy metals are also catalysts. At temperatures up to 250°C, rubber and polyvinyl chloride (PVC) stuck to the reactor surface but were completely oxidized at 294°C. Silicone rubber and Bakelite, Nalgene, and Tygon plastics were also completely oxidized at 294°C. Stainless steel was a satisfactory material of construction in initial tests in the absence of significant amounts of chloride. Small amounts of nitrate protected titanium from chloride corrosion except where PVC was retained on the wall. Further corrosion tests are required to define satisfactory materials of construction for systems containing high concentrations of chloride and/or fluoride. Candidate reactor liner materials include titanium, tantalum, glass, and ceramics. Additional chemical development work is also required to define optimum conditions for temperature and pressure for various waste combinations and the degree of off-gas cleanup required. (auth)

358 (PG-Report-991) PROCEDURES USED IN THE CALIBRATION OF ACCOUNTING TANKS. Costello, J. M.; Martin, J. Y.; Nicholson, J. C. (United Kingdom Atomic Energy Authority, Sellafield (England). Production Group). 1970. 61p. Dep. NTIS (U. S. Sales Only).

The method employed to calibrate two accounting tanks is described. The calibration equations for each tank which relate the volume contained as a function of pneumercator pressure and liquid density are presented and the precision (3σ) of calibration calculated. The recommended procedure for operating the tanks for measurement of volume is detailed. (auth) (UK)

359 RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE. Carrigan, P. H. Jr. U. S., Geol. Surv., Prof. Pap.; No. 433-G, 9p(1968).

A convenient, direct measure of simple volumetric dilution of low-level radioactive liquid wastes released from the Oak Ridge National Laboratory by waters of the Clinch River was defined. This measure of dilution is called the dilution factor. This factor is the ratio of flow in the Clinch River to flow of the radioactive liquid waste stream (Whiteoak Creek) for concurrent periods of time. Dilution characteristics of the Clinch River and Whiteoak Creek were described by means of several types of statistical analyses: central tendencies, extremes, cumulative frequency distribution, seasonal trends, and magnitude-duration-frequency curves of minimum dilution factors. To apply results of these statistical analyses, complete and steady mixing of the waters of the Clinch River and Whiteoak Creek must be assumed. Exploratory diffusion tests indicate that complete mixing in the cross section has occurred within a reasonable distance downstream from the mouth of Whiteoak Creek. Flows in the Clinch River in the vicinity of Whiteoak Creek were affected considerably by releases from Norris Lake for peak-demand hydroelectric power. Other exploratory tests indicate that the effects of the variation in flow of the Clinch River were almost completely evened out through processes of turbulent diffusion. (Meteorol. Geoastrophys. Abstr.) (auth)

360 HANDLING AND TRANSPORT OF RADIOACTIVE MATERIAL. Snyman, G. C.; Selzer, A. (Atomic Energy Board, Pelindaba, S. Afr.). S. Afr. Mech. Eng.; 20: 120-3 (Mar 1970).

The basic protective measures against exposure to external and internal radiation are indicated. The Atomic Energy Board is by statute responsible for the control of radioactive material in the Republic of South Africa and South West Africa. The Board's conditions in connection with the transport of radioactive materials are given and discussed. The requirements of the IAEA transport regulations are outlined, and some practical hints for dealing with accident conditions are given. (auth) (INIS)

361 FLASK AND ASHCAN FOR THE TRANSPORT OF RADIOACTIVE WASTE. Clergeot, Joscelin; Jourdain, Jean; Puychevrier, Jean (to Commissariat a l'Energie Atomique). British Patent 1,209,583. 21 Oct 1970. Priority date 20 Feb 1968, France.

A lead container designed to accommodate an inner vessel for transportation of dangerous material such as radioactive waste is described. The lead container is bell-shaped and incorporates an end aperture closable by movable lead members on rollers. The lead container and inner vessel are provided with handling equipment. (J.R.D.)

Vacuum Engineering

362 SIMPLE ALL-GLASS ULTRA-HIGH VACUUM SYSTEM. Ramanathan, Devaki; Vijendran, P. (Bhabha Atomic Research Centre, Bombay). Indian J. Technol.; 6: 312-14(Oct 1968).

A simple all-glass ultrahigh vacuum system capable of attaining pressures in the 10^{-10} torr region has been designed and fabricated. Besides giving reliable operation, the system has the advantages of flexibility and ease of fabrication to any particular requirement. (auth)

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INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstracts 1, 38, 44, 180, 356, 518, and 1739.

General Detectors and Monitors

Refer also to abstracts 452 and 1761.

363 (AAEC/TM–550) THE MEASUREMENT OF ^{46}Sc IN TITANIUM WIRE FAST NEUTRON MONITORS. Greig, R. A.; Bone, S. J.; Porritt, R. E. J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jul 1970. 16p. Dep. NTIS (U. S. Sales Only).

The reaction $^{46}Ti(n,p)^{46}Sc$ may be used for the routine measurement of the first neutron dose in a reactor. The ^{46}Sc is assayed either nondestructively or by a radiochemical separation procedure, depending upon the chemical state of the titanium wire monitor after the irradiation. Both methods are described and a computer program to process the data is included. (auth) (Australia)

364 (AD–707706) POTENTIAL AND LIMITATIONS OF SEVERAL NEUTRON COINCIDENCE EQUIPMENTS. Strain, Charles V. (Naval Research Lab., Washington, D. C.). May 1970. 49p. (NRL-MR–2127). NTIS.

Coincident neutron detectors which can distinguish between neutrons occurring as a result of fission and those due to (alpha, n) or (gamma, n) nuclear reactions have been described in a preceding report. The report discusses several methods of developing follow-on equipments with greater potential for the nondestructive assay of plutonium samples. The effect on equipment performance of the efficiency and neutron lifetime in the neutron detector and of analysis gate length and equipment dead times are treated in considerable detail and several illustrative examples are presented. Performance is generally improved by an increase of neutron efficiency accompanied by a decrease in neutron lifetime and the use of optimized analysis circuitry. Good performance can be obtained with complex 4 pi moderating detectors which employ an array of enriched BF_3 or ^3He neutron detection tubes dispersed in a hydrogeneous moderator. (USGRDR)

365 (AD–806313) PRELIMINARY STUDIES ON THE LUMINESCENCE EFFICIENCY OF BIOLOGICAL COMPOUNDS. Kereiakes, J. G.; Parr, W. H.; Krebs, A. T. (Army Medical Research Lab., Fort Knox, Ky.). 3 Dec 1954. 13p. (USAMRL–155). NTIS.

The effects of such factors as concentration, pH, etc. on the luminescence efficiency of biological compounds in aqueous solutions under high-energy radiation bombardment were studied. The results indicate that biological compounds quench the distilled-water solvent luminescence; that there is increased luminescence quenching with increasing concentration; and that two of the compounds studied, tryptophane and glutathione, show a dependence of luminescence on the pH of solutions. These results are discussed briefly in terms of theoretical considerations of energy transport mechanisms in irradiated solutions. (auth) (USGRDR)

366 (AECL–3564) GAMMA-RADIATION-INDUCED CURRENTS BETWEEN INSULATED DISSIMILAR ELECTRODES. Shields, R. B. (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Jul 1970. 54p. Dep. NTIS (U. S. Sales Only). AECL $2.00.

The development of a detector for measuring reactor power by in-core gamma monitoring is described. The gamma monitor is based on gamma-induced current flow from two electrodes of different materials placed close together but insulated from each other. The current results from differences in the electron emission and collection properties of the two materials. Various electrode materials, geometries, and insulators were tested. The basic theory of this gamma monitor was reported in AECL-3224. (W.H.K.)

367 (CEA-R–4048) RADIONUCLIDE DETERMINATION BY THE SUCCESSIVE SHORT SAMPLING METHOD. APPLICATION TO MEASUREMENT OF THE CONCENTRATION AND DISEQUILIBRIUM OF RADON DECAY PRODUCTS IN FREE AND CONDITIONED ATMOSPHERES. Lasseur, Claude (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Aug 1970. 158p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis. Submitted to Univ. of Toulouse, France.

An atmospheric sampling apparatus using a method for analyzing the air based on sampling over very short times at regular intervals was constructed. The apparatus was specially designed to follow changes in the natural radioactive decay products of radon in free and conditioned atmospheres. The decay equations were studied and the sampling and measurement parameters of the apparatus determined. The decay processes were studied using capillary membranes and the penetration of aerosols in the membranes was determined by a Monte Carlo method. A description of the apparatus and its calibration and operation are given. The experimental work consisted of: a study of the Rn-RaA radioactive decay and the corresponding equilibrium state; the measurement of the concentration and the disequilibrium in the atmosphere near to the ground for each short lived daughter of the radon decay chain. The effect of local weather factors is discussed. The measurement of the concentration and disequilibrium of each daughter of radon in conditioned atmospheres including laboratory, uranium mines, and reactor buildings is discussed. (France)

368 (IDO–12073, pp 25-7) INSTRUMENTATION BRANCH. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

The development, operation, and maintenance of radiation detection instrumentation is very briefly outlined. (W.H.K.)

369 (NBS-TN–537) NOMOGRAPHS FOR USE IN THE FABRICATION AND TESTING OF Ge(Li) DETECTORS. Sher, Alvin H. (National Bureau of Standards, Washington, D. C.). Aug 1970. 18p. GPO $0.30.

Six nomographs which can facilitate the fabrication and testing of lithium-drifted germanium gamma-ray detectors [Ge (Li) detectors] have been constructed which relate the following parameters: (1) time, temperature, applied bias, and drifted depth; (2) lithium mobility, crystal resistivity, and oxygen concentration; (3) area, capacitance, and drifted depth for planar Ge(Li) detectors; (4) drifted depth, length, and capacitance for coaxial Ge(Li) detectors; (5) total spectral resolution, system noise, and detector resolution; and, (6) detector resolution, gamma-ray energy, and effective Fano factor. The use of these nomographs is described and illustrative examples are given. (auth)

370 (NYO–3510-15) BIOLOGICAL AND CLINICAL DOSIMETRY. Annual Progress Report, July 1, 1969–June 30, 1970. Laughlin, John S. (Sloan-Kettering Inst. for Cancer Research, New York). Contract AT(30-1)-3510. 79p. Dep. CFSTI.

Investigations of the characteristics of neutron beams from the SKI cyclotron are being continued, and a tissue equivalent calorimeter to permit direct determination of absorbed dose from the neutron beams is under construction. Biological studies indicating a decrease in RBE with depth for neutrons from the $^9Be(^3He,n)$ reaction have been correlated with measurements of the dose fraction as a function of LET. The nanosecond integrator system described in our previous progress report served as a prototype for the final system which is now essentially complete. It has been thoroughly tested and used to measure the output pulse produced by the beam current monitor. A scintillation detector system has been constructed to measure the output of ultra-high intensity pulsed electron sources. A thin foil calorimeter has been constructed, and is being used to measure the dose delivered to a thin layer of material in fundamental units (rads). The techniques for fabrication of germanium diodes were successfully established. A plane, cylindrical, germanium diode, lithium drifted 3mm deep, was selected for use in an orthogonal strip array. Resolution of ^{60}Co (1.17, 1.33 MeV) and ^{57}Co (122 keV) gamma-rays was 3 keV (FWHM) and 1.4 keV (FWHM) respectively. A novel dual chamber vacuum cryostat was designed and constructed. This unit is needed to house and test a germanium diode matrix at cryogenic temperatures. An experimental system was designed and constructed for operating and evaluating germanium diode matrix arrays fabricated at the Institute. (auth)

371 (SRARI-P–67) CONSTANT BASE LINE RESTORER AND OVERLAPPING REJECTING CIRCUIT FOR HIGH-PRECISION AMPLITUDE SPECTROMETERS WITH RC-CR FORMATION. Ivanov, V. B.; Reshetov, N. N.; Shipilov, V. I. (Scientific Research Atomic Reactor Inst., Melekess (USSR)). 1970. 23p. (In Russian). Dep. NTIS (U. S. Sales Only).

Modernized base line restorer and overlapping distorted pulse rejecting circuits are described allowing amplitude measure-

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ments with semiconductor detectors at input rates up to 10^5 pps with calibration scale stabilization and resolution deterioration by at most 0.5 to 0.7 keV as compared to the low rate results. (auth)

372 (UCRL-72739) CONSTRUCTION OF A UNIQUE UNDERGROUND WHOLE BODY COUNTER. Griffith, R. V.; Anderson, A. L.; Lindeken, C. L. (California Univ., Livermore. Lawrence Radiation Lab.). Oct 1970. 27p. (CONF-701009-1). Dep. NTIS.

From 16th Annual Bioassay and Analytical Chemistry Conference, Bethesda, Md.

A series of four articles on the LRL Whole Body Counter which appeared in previous LRL Hazards Control Progress Reports is presented. (W.H.K.)

373 PRODUCTION OF N-I-P SILICON RADIATION DETECTORS MADE BY LITHIUM ION IMPLANTATION. Koh, Youn Kyu (Yonsei Univ., Seoul). J. Nucl. Sci. (Seoul); 10: No. 1, Pt. 1, 17-22(Jun 1970).

The experimental apparatus and procedure for production of n-i-p silicon detectors are described. Metallic Li^+ ions are implanted in p-type silicon of low resistivity, and after the n-p junction is formed the depth of the intrinsic region is increased by using the drift method. The characteristics of the n-i-p detector are described. (W.H.K.)

374 A SPECTROMETRIC METHOD FOR THE MEASUREMENT OF THE INTENSITY OF NATURAL GAMMA EXPOSURE WITH EXAMINATION OF THE ANGULAR RESPONSE OF A 3'' BY 3'' NaI(Tl) CRYSTAL. Cardinale, A.; Frittelli, L.; Lembo, G. (CNEN, Rome). G. Fis. Sanit. Prot. Radiaz.; 12: 125-33(Jul-Sep 1968). (In Italian). (RT/PROT-(69)-19).

A spectrometer for measurement of the intensity of natural γ exposure using a NaI(Tl) crystal was developed. The problem was that of determining a A/I factor valid for that particular spectrometer, which makes it possible to derive the exposure I measuring the area A of the peak. The factor A/I was calculated for the portable spectrometer, and the intrinsic efficiency on the photopeaks of different elements was determined as a function of energy. Experiments confirmed the importance of geometric conditions for a correct application of the spectrometric method for the measurement of the exposure intensity in the field. (J.S.R.)

375 APPLICATION OF CATHETER-TYPE SEMICONDUCTOR RADIATION DETECTOR (CASRAD) TO THE PULMONARY FUNCTION STUDIES. Mori, Masashi (Tokyo Univ.). Tokyo Igaku Zasshi; 77: 263-72(Dec 1969). (In Japanese).

A new approach to the measurement of pulmonary functions using a catheter-type semiconductor radiation detector (CASRAD) and ^{85}Kr is described. Its advantages and limitations are compared with the conventional external counting methods. The result of basic experiment confirmed that intrabronchial count rate and ^{85}Kr concentration are linear and that the count rate cannot be affected by the presence of ^{85}Kr in the surrounding tissue. In animal experiments with dogs, ^{85}Kr saline solution was injected into the right heart to measure the count in the upper and the lower bronchi in both upright and supine positions. The count rate of the lower bronchus was higher than that of the upper bronchus in upright position presumably associated with the increased pulmonary blood flow due to gravity. The count rate in upright position was found to be several times higher than in supine position in both bronchi due to the reduced cardiac output. No significant difference was observed in the washout rate of ^{85}Kr from both bronchi. The clinical applicability was confirmed in the trial use in ventilatory function, lobar circulation and bronchospiratory function tests. (T. Matsumura) (Japan)

376 ALPHA DETECTOR INSENSITIVE TO HIGH NEUTRON AND GAMMA BACKGROUNDS AND TEMPERATURE. Splichal, W. F. (E. I. du Pont de Nemours and Co., Inc., Aiken, S. C.). Health Phys.; 19: 576-7(Oct 1970).

A simple air proportional detector is described capable of detecting only high-level alpha activity without being affected by high neutron and gamma backgrounds and surface temperatures. 10^6 to 10^{10} dis/min of alpha activity can be easily detected in the presence of 1500 rem/hr neutron and 500 R/hr gamma backgrounds and a 250°F surface temperature. The detector can be operated (without a preamplifier) up to 25 ft from the portable four-decade logarithmic readout meter; personnel radiation exposure is reduced. The detector may be used to measure lower alpha levels with no reduction in gamma rejection level but with a reduction in the neutron rejection level. Circuit details are given. (auth) (UK)

377 DEVELOPMENTAL SCINTILLATION COUNTER FOR DETECTION OF PLUTONIUM IN VIVO. Swinth, K. L.; Griffin, B. I. (Battelle-Northwest, Richland, Wash.). Contract AT(45-1)-1830. Health Phys.; 19: 543-50(Oct 1970).

A scintillation counter utilizing 52 low-noise 2 in. phototubes with 1 mm sodium iodide crystals was fabricated for the detection of plutonium in vivo. When counting the 17 keV x-rays from plutonium deposited in the lungs, the counter has a sensitivity of 0.385 counts/min per nCi which increases to 2.63 counts/min per nCi when counting both the x-rays and the 60 keV ^{241}Am γ-rays. Background rates vary among individuals due to the presence of various isotopes (^{40}K, ^{137}Cs, etc.), but the background at higher energies can be used to predict the background rate in the 17 keV and 17 keV plus 60 keV regions. Two standard deviations of the background in the 17 keV x-ray region correspond to 20 nCi of plutonium in the lungs. The counter has been used to detect plutonium in people, animals, and biological samples. (auth) (UK)

378 IMAGING PROPERTIES OF THE POSITRON CAMERA. Krauss, O.; Lorenz, W. J.; Luig, H.; Ostertag, H.; Schmidlin, P. (Inst. of Nuclear Medicine, Heidelberg). Nucl.-Med.; 9: 103-19(30 Jun 1970).

The imaging properties of a Nuclear Chicago type Rho/Gamma III positron camera were investigated. The positron emitting nuclide ^{64}Cu was used in the experiments. The edge packing effect of the detectors was eliminated by ring-shaped lead shields. The resolution, the sensitivity, and the tomographic effect of the positron camera were measured with line phantoms. The best resolution was 8 mm (FWHM). Using tomoscintigrams of a volume phantom with four hot or four cold nodules in different planes, the imaging properties of the positron camera for extended activity distributions are discussed. Because of the complex imaging properties of the positron camera the tomography of voluminous activity distributions is only useful if digital evaluation methods are employed. (auth)

379 SEMI-EMPIRICAL EFFICIENCY CURVE FOR A THIN Ge(Li) DETECTOR AT LOW ENERGIES. Chung, M. K.; Suh, D. W.; Cho, S. W.; Kim, E. K. (Atomic Energy Research Inst., Seoul). J. Nucl. Sci. (Seoul); 10: No. 1, Pt. 1, 7-15(Jun 1970). (In Korean).

Recently several workers tried a semi-empirical approach to the determination of the relative total-energy-peak efficiency, ξ, in the low gamma-ray energy range. They adopted the semi-empirical formula $\xi \propto \tau + A\delta \exp(-BE)$, where τ and δ are photoelectric and Compton absorption coefficients respectively, E is the gamma-ray energy and A and B are constants determined from the measured values of detection efficiencies. In spite of the good fit to the experimental curve by this formula for higher energies, this curve deviates considerably from measured values in the range, 500 to 600 keV. By the accurate analysis of our experimental data, we found that the formula, $\xi \propto A \cdot \exp(-BE)$, which is independent of the absorption coefficients, can account experimental data more accurately in the energy range, E > 700 keV. For lower energies than 700 keV, the formula, $\xi \propto \tau + A\delta B^{-B}$, shows excellent agreement with the observed data. Our results show the contribution from multiple Compton scattering to the total energy peak varies with the energies as $A\delta\exp(-BE)$ for higher energies and as $A\delta E^{-B}$ for lower energies. It is also proved the formula $A \cdot \exp(-BE)$ can be deduced from the $\tau + A\delta \exp(-BE)$ in the case of a thin detector. Utilizing experimental results, intensity ratios of ^{198}Au and ^{116m}In gamma-rays were re-calibrated: γ_1 (411.793 keV)/γ_2 (675.88 keV)/γ_3 (1087.69 keV) = 100/0.85 ± 0.056/0.218 ± 0.021 for ^{198}Au and γ_1 (138.32 keV)/γ_2(417.0 keV)/γ_3(818.80 keV)/γ_4 (1097.20 keV)/γ_5 (1293.30 keV) = (3.00 ± 0.41)/(20.94 ± 1.46)/(10.98 ± 1.14)/(61.92 ± 6.26)/80 for ^{116m}In gamma-rays. (auth)

380 STUDY OF PULSE CHARACTERISTICS OF RCA-6810A PHOTOMULTIPLIER TUBE USING SPARK COUNTER AS A PULSER. Sharma, S. C.; Chauhan, S. D. (Univ. of Delhi). Indian J. Pure Appl. Phys.; 7: 820-2(Dec 1969).

The transit time, transit-time spread and absolute gain for the RCA-6810A photomultiplier tube have been measured using a spark counter as a fast pulser which initiated electrical and light pulses simultaneously, and employing fast coincidence techniques. At an operating voltage of 1500 V the average transit time is found to be 24 ± 0.3 nsec and the transit-time spread ~3.0 nsec. Further, the observed transit time is found to vary inversely as the square root of the applied voltage over the range 1500 to 2250 V. The absolute gain of the tube is estimated to be $\sim 3.27 \times 10^6$. (auth)

381 CALCULATION OF THE RESPONSE OF BRAMBLETT-BONNER SPHERES BY MEANS OF A MULTIGROUP THEORY. Lamberieux, J. (CEN de Cadarache, Saint-Paul-Les-Durance, France). Radioprotection; 5: 19-35(1970). (In French).

The response of Bramblett-Bonner spheres was calculated be-

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tween thermal energy and 50 keV by means of a multigroup theory. The theory of neutron scattering at constant energy and its extension to the theory of multigroup slowing-down are studied in turn. An attempt is made to apply the formulas obtained to the special case of Bramblett spheres, assumed to be immersed in an isotropic flux. (auth) (France)

382 STUDY ON THE CHARACTERISTICS OF SOME PERSONAL AIR SAMPLERS. Ohata, Tsutomu; Hongo, Shozo; Suzuki, Masashi (National Inst. of Radiological Sciences, Chiba, Japan). Hoken Butsuri; 5: No. 2, 63-8(Jun 1970). (In Japanese).

This report describes the results of the test for sampling characteristics of some personal air samples which are widely used for estimating the hazard due to inhalation of airborne harmful materials in the nuclear fuel plants and other industrial installations. The personal air samplers investigated are three kinds, namely, of the trade mark of MSA Monitaire Sampler, UNICO Mighty Mite and Casella MK II. In order to measure the flow rate of each sampler, a transducer was calibrated by means of other experimental procedure, before the flow rate tests were made. The battery capacity without the load and the maximum load under the constant voltage supply were also studied. The maximum flow-rate without the load was about 5 l/min in the UNICO, 4 l/min in the MSA and 2 l/min in the Casella, respectively. The sampling air volume of the UNICO sampler is, however, most decreased by the increase of load, compared with those of the Casella and the MSA samplers. Some other basic data useful for improving the characteristics of samplers were also obtained. (auth) (Japan)

383 SUPER NEUTRON MONITOR FOR GROUND LEVEL CONTINUOUS OBSERVATION. Miyazaki, Yukio; Kawasaki, Shinkichi; Nakai, Katsuyuki; Wada, Masami (Inst. of Physical and Chemical Research, Yamato, Japan). Rikagaku Kenkyusho Hokoku; 46: No. 4, 67-81(Jul 1970). (In Japanese).

A continuous observation of cosmic ray neutron intensity by means of a super neutron monitor with 9 counters (9-NM-64) was started in Tokyo in 1969. The construction of device and the method of data reduction, as well as the special features such as multiplicity distribution and barometer coefficient obtained in the beginning of observation are described. (auth) (Japan)

384 APPLICATION OF SOLID-STATE TRACK DETECTORS FOR MEASURING ALPHA-PARTICLE ANGULAR DISTRIBUTIONS IN NUCLEAR REACTIONS. Somogyi, G.; Schlenk, B. (Inst. of Nuclear Research, Debrecen, Hungary). Radiat. Eff.; 5: 61-8(Aug 1970).

The track diameter of particles entering the track detectors at right angles shows a strong dependence on the energy and type of particles. Some general features of this effect are discussed. It is shown that, even in glass, different heavy nuclei can be distinguished according to their track diameters. New data are presented for α particles registrated in Makrofol E. Using the correlation between α-particle energy and track diameter, detailed investigations have been carried out to measure angular distributions of α-groups from nuclear reactions. Preliminary experimental results obtained for reactions $^{19}F(d,\alpha)$ and $^{27}Al(d,\alpha)$ at very low bombarding energies are presented. (auth)

385 CALIBRATION OF PLASTIC TRACK DETECTORS FOR USE IN COSMIC-RAY EXPERIMENTS. Blanford, G. E. Jr.; Walker, R. M.; Wefel, J. P. (Washington Univ., St. Louis). Contracts Z80058T; NAS 9-8352. Radiat. Eff.; 5: 41-5(Aug 1970).

The response of plastic track detectors to heavy charged particles from the HILAC was determined. The rates of track etching as a function of particle charge and velocity are presented for cellulose tri-acetate and cellulose acetate butyrate plastic and are compared to previously measured response curves of Lexan polycarbonate and cellulose nitrate plastics. Application of these data to the determination of nuclear charges by the method proposed by Price and coworkers is discussed. A variant of this method based on measurements of track diameters is also presented. Finally, data on the change in calibration for plastics exposed to different environmental conditions prior to etching are presented. No effect of gamma irradiation is observed up to a total dose of 18,000 roentgen. In contrast, there is a marked effect on the rate of track etching between samples stored in air at different temperatures after irradiation. (auth)

386 USE OF SOLID-STATE NUCLEAR TRACK DETECTORS IN REACTOR PHYSICS EXPERIMENTS. Tuyn, J. W. N. (Reactor Centrum Nederland, Petten, Netherlands). Radiat. Eff.; 5: 75-84(Aug 1970).

Solid state nuclear track detectors of silver-activated phosphate glass and polycarbonate plastic have provided intracell fission density and fast neutron flux distributions in the zero-power critical facility NORA. The fission density distributions were measured in a clean lattice and within fuel elements in the vicinity of grey absorber control elements. The measured intracell fast neutron flux distributions were used for the evaluation of the so-called "fast advantage factors" (fuel-to-moderator neutron flux ratios at fission energies). Integral measurements of the fast advantage factors were performed by foil activation. As far as the experimental results could be compared with theoretical calculations, a good agreement was found. For the measurement of the track density distributions along the detector surface, a method was developed which replaces the counting procedure of tracks under a microscope. This method is based upon the relation between track density and intensity of transmitted light through irradiated and etched detectors, whereby a microdensitometer is used for the measurement of the light transmission. Some remarks about the fast neutron sensitivity of Makrofol polycarbonate plastic are made. (auth)

387 MECHANISM OF TRACK FORMATION IN POLYMERS. Monnin, M. (Laboratoire de Physique Nucleaire, Clermont-Ferrand, France). Radiat. Eff.; 5: 69-73(Aug 1970). (In French).

The distribution of energy deposited around the trajectory of a heavy ion in a solid-state organic polymer is calculated. First, one calculates the energy deposited by secondary electrons, then the distribution of energy released directly by the incident particle. These distributions allow prediction of the maximal energy of recorded ions according to the fact that a minimal dose is required to induce sufficient damage. (auth)

388 PRELIMINARY RESULTS OF MEASUREMENTS ON TRACKS OF HEAVY COSMIC RAYS IN PLASTIC DETECTORS. Enge, W. (Institut fuer Reine und Angewandte Kernphysik, Kiel); Bartholoma, K.-P.; Fukui, K.; Filz, R. C. Radiat. Eff.; 5: 123-4 (Aug 1970).

A stack of Zelux polycarbonate and Daicel cellulose nitrate sheets was flown to 1.5 g/cm^2 altitude. In preparation for particle identification by track measurement, the etching of Zelux (stress-relieved Lexan) and Lexan by NaOH solution was studied; the two materials were found to be identical in etching characteristics. The method was calibrated by measuring the etching rate of 10.2-MeV Ne and Ar ion tracks in Zelux as a function of restricted energy loss. (D.L.C.)

389 POLYVINYL CHLORIDE: AN INTERESTING TRACK DETECTOR. Monnin, M.; Sanzelle, S. (Univ., Clermont-Ferrand, France). Radiat. Eff.; 5: 125-8(Aug 1970). (In French).

It is shown that polyvinyl chloride is a polymer of sensitivity comparable to that of cellulose nitrate. In this polymer, the time when tracks appear depends critically upon ion energy and permits good discrimination. (auth)

390 INFLUENCE OF ETCHING PARAMETERS ON SENSITIVITY OF PLASTICS. Somogyi, G. (Inst. of Nuclear Research, Debrecen, Hungary); Varnagy, M.; Medveczky, L. Radiat. Eff.; 5: 111-16(Aug 1970).

It seems that the critical rate of primary ionization for track registration must also depend on the etching conditions. Simple experimental methods are presented to show a possible change in registration sensitivity as a function of the chemical parameters. It was proved, from investigations of α-particle tracks, that the sensitivity of a cellulose acetate detector can considerably depend on the concentration and type of etching reagent. Quantitative data are given on the ratio of the rate of chemical etching along the track and on the detector surface as a function of concentration of NaOH solution for tracks of fission fragments registered in plastics of cellulose acetate, polycarbonate, and polyethylene-terephthalate. (auth)

391 STUDY OF TRACK REGISTRATION IN THE REGION OF THE CRITICAL ENERGY. Beaujean, R.; Meyerbroeker, H.; Enge, W. (Institut fuer Reine und Angewandte Kernphysik, Kiel). Radiat. Eff.; 5: 47-8(Aug 1970).

A latent track in a plastic detector can be etched to a visible track, if the ratio of the track etching rate v_t to the bulk etching rate v_b is greater than 1. The etching rate in a specific material for a given particle depends on the particle's energy. For a given particle, the critical energy E_c is defined by $v_t(E_c) = v_b$. The track etching rate approaches the bulk etching rate near the critical energy in an asymptotic manner. The critical energy of cellulose nitrate was determined by using vertical incident alpha particles. The relation of the track diameter, the etching time, and the energy of the particle can be calculated using the track and the bulk etching rate. In the region $E \geq 3$ MeV, the curve $v_t(E)$ was unknown. For this calculation $v_t(E)$ was set to be $v_t = v_b$ for

$E \geq 5$ MeV and as E decreases to 3 MeV, $v_t(E)$ increases to $v_t(3\ MeV) = 2v_b$. Comparing the measured and the calculated curves, the critical energy of α particles in cellulose nitrate was found to be higher than 5 MeV. The calculation predicts that the curves of track diameters as function of the etching time using the energy as parameter are parallel to each other as E increases beyond E. The measured curves are not parallel up to 6–7 MeV. The function $v_t(E)$ can be obtained by fitting the calculated curves to the measurements. (auth)

392 CONTROL OF ENRICHMENT OF METALLIC URANIUM BY MEANS OF CELLULOSE NITRATE. Chapuis, A.-M. (CEN, Fontenay-aux-Roses, France); Francois, H.; Gerard-Nicodeme, N. Radiat. Eff.; 5: 91-7(Aug 1970). (In French).

Cellulose nitrate can be used for the registration of α-tracks and therefore for the measurement of the specific activity of thick radioactive sources. This characteristic is applied to the determination of ^{235}U enrichment rate of metallic uranium samples. For the measurement of track density, a method is developed which replaces the counting procedure under a microscope. The samples are etched in special solutions and track density is evaluated from the diffuse reflecting power of the samples. The main advantages of this method are its rapidity, ease, and low cost. (auth)

393 RAPID-READING TECHNIQUE FOR NUCLEAR PARTICLE DAMAGE TRACKS IN THIN FOILS. Cross, W. G.; Tommasino, L. (Chalk River Nuclear Labs., Ont.). Radiat. Eff.; 5: 85-9(Aug 1970).

The low background of damage track detectors allows them to measure low integrated fluxes of charged particles or neutrons. When good statistical accuracy is desired, the long times required for visual track counting under the microscope may seriously limit the number of measurements, particularly when the track density is low. A technique has been developed for automatically counting etched tracks that pass through a thin film. Very simple and inexpensive equipment is required. The insulating film is placed between a plane, high-voltage electrode and a thin layer of Al. A spark, passing through the film along a damage track, evaporates a hole in the Al. A second spark is prevented from starting through the same hole, so that the discharge passes successively along each track and then stops. Sparks are counted with a scaler. The pattern of holes in the Al provides a visible replica of the pattern of tracks. Track densities from background level to 3000 tracks/cm^2 can be measured. Areas up to 100 cm^2 are usually counted in less than 10 seconds, with an error of a few per cent in the number of tracks. The technique has been applied to neutron dosimetry and to measurements of angular distributions in photofission. (auth)

394 MEASUREMENT OF CONE LENGTH AND RANGE IN ETCHED PLASTICS. O'Ceallaigh, C.; Daly, J. (Inst. for Advanced Studies, Dublin). Radiat. Eff.; 5: 135-8(Aug 1970).

The measurement of track parameters in lexan sheets involves the location of the apparent top surface of the etched plastic, the location of the tips of the entrance and exit cones, and the location of the apparent bottom surface using a microscope. The apparent depth of a cone-tip below the extinction point for the surface may be estimated either with the cone–base uppermost, or the sheet inverted. The two ways differ by about 2 μm, and possible causes of the discrepancy are examined. It is pointed out that thick supporting plates between the condenser and the sample should be avoided, and that the breath of the observer can produce movements of the lexan sheet. (D.L.C.)

395 TRACK REVEALING AND VISUALIZATION. Medveczky, L. ATOMKI (At. Kut. Intez.) Kozlem.; 12: 11-15(Jun 1970).

The procedures for revealing the particle tracks in dielectric track detectors in order to make them visible under an optical microscope are described including direct observation in an electron microscope; decoration–forming an optically-distinguishable phase layer of material along the damaged track; and chemical etching. (37 references) (W.H.K.)

396 NOTES ON EXPERIMENTAL TECHNIQUE AND APPARATUS. Campion, P. J. (National Physical Lab., Teddington, Eng.). J. Phys., E (London); 3: 920-2(Nov 1970).

A counting rate plateau ends when the gain of the system is such that spurious pulses are detected. For those radiation detectors in which the majority of spurious pulses are produced in a relatively short interval of time following a genuine pulse, a very sensitive method for detecting the end of the plateau consists of observing only those pulses which occur within a few tens of microseconds after a genuine pulse. The gain in sensitivity can be as much as several orders of magnitude over the conventional method and is greater for lower counting rates. (auth) (UK)

397 STUDIES ON THREE-DIMENSIONAL SCINTIGRAPHY WITH $\gamma-\gamma$ COINCIDENCES. Schmitz-Feuerhake, Inge (Medizinische Hochschule, Hanover). Phys. Med. Biol.; 15: 649-56 (Oct 1970).

By means of phantom studies, it is shown that three-dimensional scintigraphy is possible with $\gamma-\gamma$ cascade isotopes, such as ^{75}Se. Large plastic scintillators and slit collimators are proposed for additional coincidence detectors which observe one plane only. The necessary conditions for the technical performance of the apparatus are derived. Some suitable isotopes are discussed. (auth) (UK)

398 MODIFICATION OF A COUNTING RATEMETER TO REDUCE THE EFFECT OF STATISTICAL FLUCTUATIONS. Dean, P. M. (London Hospital, Whitechapel, Eng.). Phys. Med. Biol.; 15: 695-9(Oct 1970).

If the count rate from a radioactive source is measured with a linear ratemeter, the absolute magnitude of the statistical fluctuations in ratemeter deflection increases with count rate. By using a ratemeter with a deflection proportional to the square root of the mean count rate the statistical variation in deflection is constant, the variation at full scale deflection is one half that of a linear meter for a given maximum count rate, and the variation is smaller than that of a linear ratemeter for all count rates above one quarter of the maximum count rate. The construction and calibration of a square-rooting circuit comprising a series of resistor diode networks is described. The technique was applied to the Picker Magnascanner color display resulting in improved color edge definition. (auth) (UK)

399 COMPARISON OF RADIOISOTOPE IMAGING DEVICES USING PLANE SOURCE DISTRIBUTIONS. Galvin, J. M.; Simmons, G. H.; Kereiakes, J. G. (Cincinnati General Hospital). Phys. Med. Biol.; 15: 735-8(Oct 1970).

A comparison of several detector–collimator combinations for rectilinear scanners with 7.5 and 12.5 cm diameter detectors and a scintillation camera is presented. The comparison is based on a figure of merit using plane spread functions to compute the modulated transfer function values and sheet sources of radioactivity to determine sensitivity. (UK)

400 SEMICONDUCTOR NUCLEAR RADIATION DETECTORS. Parker, R. P. (Inst. of Cancer Research, Sutton, Eng.). Phys. Med. Biol.; 15: 605-20(Oct 1970).

Semiconductor radiation detectors were originally produced in the user's own laboratory, and since the initial interest came from nuclear physicists, medical applications are few. Many types of detector such as silicon planar devices and lithium-drifted germanium γ-spectrometers are now commercially available and more widespread applications are becoming evident. These are at present diverse, but are primarily concerned with x- and γ-ray spectrometry. Higher detection efficiencies and room temperature operation would greatly facilitate routine use, and it is to be hoped that efforts will be made to improve detector geometry (e.g. by well-type and multi-crystal devices) and examine new materials. Heavy-particle and neutron studies are of necessity limited, but in vivo β-counting is now possible, although its applications are largely unexplored. Semiconductor detectors possess many advantages and some disadvantages: the next few years should see them taking a significant role in many medical and biological investigations. (auth) (UK)

401 CONTROLLED ANALOGUE PULSE HEIGHT STORE. Koeman, H. (Philips' Research Labs., Amsterdam). Nucl. Instrum. Methods; 86: 301-9(1970).

The analogue pulse height stores the height of an input signal (5 V max.) up to maximally 100 μsec after the time of occurrence of the peak of the input signal within an accuracy of 0.6 mV. The analogue pulse height store can be used in series with the input of an 8192 channel analogue-to-digital converter and may serve the purpose of "time-derandomizing." The advantage of such a circuit when converting analogue information obtained from radiation detectors into digital information is shown. The circuit is composed of a linear gate and stretcher and associated control circuit. The operation of the control circuit of the analogue pulse height store circuit is influenced by the threshold, lower level and upper level discriminators, (anti)-coincidence requirements and analogue pulse height store reset signal. At the moment that stored information is available the control circuit generates an "analogue pulse height storage ready" signal. Ambient temperature changes and repetition rate variations do not effect the output base line level significantly. Dielectric absorption in the storage capacitor and loss of charge effects are compensated. (auth)

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402 LOW ENERGY PHOTONS FROM ^{152}Eu FOR Ge(Li) CALIBRATION. Notea, A.; Elias, E. (Technion-Israel Inst. of Tech., Haifa). Nucl. Instrum. Methods; 86: 269-72(1970).

Intensities of low energy gamma and X-rays in the decay of 12.4 y ^{152}Eu were measured. A branching ratio of 1.84 ± 0.17 between the decay by β^- emission to ^{152}Sm and via EC and β^+ to ^{125}Gd was found from the relative X-rays and 344 keV intensities. The measured energies in keV and the absolute intensities in photons per 100 disintegrations are: 39.5 ± 0.2 (45_3 ± 5.8), 45.2 ± 0.2 (11_3 ± 1.4), 121.9 ± 0.1 (27_7 ± 3.1), 244.75 ± 0.08 (7.5_2 ± 0.85), 295.8 ± 0.1 (4.5_2 ± 0.61), 344.44 ± 0.09 (24_5 ± 2.7), 367.8 ± 0.2 (0.72_1 ± 0.086), 411.3 ± 0.2 (1.9_4 ± 0.24), 444.2 ± 0.2 (2.9_6 ± 0.33). The nucleus is recommended as a calibration standard for Ge(Li) detectors. (auth)

403 EFFECT OF CHARGE TRAPPING ON THE SPECTROMETER PERFORMANCE OF p-i-n SEMICONDUCTOR DETECTORS. McMath, T. A.; Martini, M. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nucl. Instrum. Methods; 86: 245-52(1970).

Because of the effects of charge trapping, the mean pulse amplitude varies with position of interaction in a p-i-n detector; several theories have been developed to predict the shape of the full energy peak on the basis of this variation. Contrary to the assumptions of these theories, it is shown that the spread in amplitude also varies with the position of interaction. The shape of the full energy peak observed for uniform irradiation of the sensitive volume of a planar detector has been compared with the peak shape calculated using a theory modified to include the variation of the spread in amplitude as a function of the position of interaction, using trapping parameters determined from collimated beam measurements made on the same detector. Good agreement between the shapes of the calculated and observed peaks was obtained. (auth)

404 CURRENT MONITOR FOR LOW INTENSITY PULSED ELECTRON BEAMS. Costello, D. G.; Lonergan, J. A. (Gulf General Atomic Inc., San Diego, Calif.). Nucl. Instrum. Methods; 86: 315-16(1970).

A thin ΔE silicon detector which was used to monitor pulsed electron beams from an electron linear accelerator is described. (auth)

405 RESPONSE OF SILICON SURFACE-BARRIER DETECTORS IN AXIAL MAGNETIC FIELDS UP TO 100 kG. Byrne, J. (Univ. of Sussex, Brighton, Eng.); Shaikh, F.; Bonner, B. E. Nucl. Instrum. Methods; 86: 323-4(1970).

Results are presented of a study of the response of silicon surface-barrier detectors maintained at 273°K in axial magnetic fields in the range from zero to 100 kG. (auth)

406 UNIFORMITY OF THE LIGHT OUTPUT FROM VERY THIN LARGE-AREA PLASTIC SCINTILLATOR PLATES. Schoenfelder, V. (Max-Planck Institut fuer Physik und Astrophysik, Garching, Ger.). Nucl. Instrum. Methods; 86: 327-9(1970).

Absorption and reflection losses in very thin large-area plastic scintillator plates and the influence of the plate thickness on the uniformity of the light output are investigated. (auth)

407 APPARATUS FOR MONITORING PULSES. (to Gulf General Atomic Inc.). British Patent 1,204,011. 3 Sep 1970. Priority date 31 May 1967, United States.

A Campbelling-type radiation detector circuit is described. The output signal is proportional to the log of the average rate of random pulses. (W.H.K.)

408 EVALUATION OF THE SPATIAL PARAMETERS K AND α IN EQUATIONS FOR FISSION-TRACK URANIUM ANALYSIS. Kleeman, J. D.; Lovering, J. F. (Australian National Univ., Canberra). Radiat. Eff.; 5: 233-7(Oct 1970).

The equations describing fission track densities registered in solid-state detectors contain some spatial parameters whose values are not well known. The product of K, a geometric factor approximately equal to the range of fission fragments in a solid, and α, the etching efficiency, is determined by simultaneously producing fission tracks from a glass of known uranium content and monitoring the thermal neutron dose using gold foil. For tracks recorded in Lexan plastic and produced by uranium in alumino-silicate glass, the value of this product is 8.1×10^{-4} cm (±7 per cent), and for tracks etched in the glass matrix itself it is 3.7×10^{-4} cm (±8 per cent). These values are consistent with analagous values calculated from other published data, and by assuming a value of $\alpha = 1$ for Lexan plastic, K is found to be 8.1×10^{-4} cm (±7 per cent). (auth)

409 SEMICONDUCTOR DEVICE FOR DETECTING AND/OR MEASURING RADIATION. Oosthoek, Dirk Pieter; Kok, Erwin (to Philips Corp.). U. S. Patent 3,529,161. 15 Sep 1970. Priority date 1 Mar 1966, Netherlands.

A detector for energetic particles comprising a single crystal disc of semiconductor material with electrodes on opposite surfaces is described. Each electrode is subdivided into a plurality of parallel, spaced, strips which cross the strips of the other electrodes forming a so-called checker board counter which allows the precise point where the particle impacts on the disc to be located. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstract 1941.

410 (AD-704786) GAMMA SPECTRA DATA PROCESSING PROGRAMS. Riel, Gordon K.; Madigosky, Susan W.; Simons, Donald G. (Naval Ordnance Lab., White Oak, Md.). 11 Dec 1969. 70p. (NOLTR-69-233). CFSTI.

The FORTRAN IV programs for processing spectra (number of events per energy interval histograms) include: GAMMA, which normalizes the zero intercept and energy per interval; SPEC, which determines quantitatively the radioisotopes in the spectra by sequential subtraction of standard spectra; MONTE CARLO, which produces standard spectra for a given detector and incident energy; and MERGE, which combines standard spectra of various energies to duplicate the spectrum of a radioisotope. GAMMA, MERGE, AND SPEC will work for any consistent set of histograms, while MONTE CARLO contains parameters for a sodium iodide (thallium) gamma-ray detector in an infinite medium containing a uniformly distributed source. The programs are used to analyze the concentration of radioisotopes in water. (auth) (USGRDR)

411 (AD-708466) DESCRIPTION AND CALIBRATION OF THE PROTON SPECTROMETER FLOWN ON SATELLITE 1969-25C (OV-19). Report for October 1967-October 1969. Stevens, John R. (Aerospace Corp., El Segundo, Calif.). 1 Jun 1970. Contract F04701-69-C-0066. 46p. (TR-66(5260-20)-14; SAMSO-TR-70-225). NTIS.

A proton spectrometer measures the directional differential flux of protons with energy from 0.18 to 2.81 MeV. The calibration of the proton energy thresholds and the count-rate meters are described. Background effects are also discussed. Background counting rates in the pulse-height analyzer caused by penetrating protons were negligible only if the energy spectrum of protons fell more rapidly than E to the -2 above E sub p + 10 MeV. The background counting rate due to low-energy electrons can be neglected only if the differential electron flux at 300-keV energy is <1.2 million electrons/square cm-sec-sr-MeV. Corrections for background due to penetrating protons, low-energy electrons, and high-energy electrons are described. (auth) (USGRDR)

412 (AD-708877) CONCEPT FOR THE MEASUREMENT OF GAMMA-RAY SPECTRA FROM PULSED REACTORS OR FLASH X-RAY MACHINES. Van Antwerp, Walter R. (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Mar 1970. 19p. (BRL-TN-1731). NTIS.

The report describes a concept for the measurement of gamma-ray spectra using fixed-energy variable-angle Compton electrons. The choice of a single electron energy eliminates variations in detector response and it can also eliminate the need for variations in detector geometry. Although the dispersion of the proposed spectrograph is very poor at higher gamma-ray energies, this is considered to be an advantage for the low intensities of high-energy gamma-rays produced by flash x-ray machines or pulsed reactors. (auth) (USGRDR)

413 (N-70-27711) CODE TO UNFOLD SCINTILLATION SPECTROMETER POLYENERGETIC GAMMA PHOTON EXPERIMENTAL DISTRIBUTIONS. Steyn, J. J.; Born, U.; Strahl, J. T.; Huang, R. (NUS Corp., Rockville, Md.). Sep 1969. Contract NAS5-10337. 132p. (NASA-CR-109848; NUS-557). NTIS.

A FORTRAN code was developed for the IBM-360 digital computer to unfold sodium iodide (thallium-activated) scintillation spectrometer polyenergetic gamma photon experimental distributions. It was specifically designed to analyze the combination bremsstrahlung and monoenergetic gamma radiation field of cylindrical radioisotope power generators. The code generates the detector system response matrix function and applies it to the monoenergetic spectral components discretely and to the bremsstrahlung iteratively. It corrects for iodine K x-ray escape, detector non-linearity, system drift, source decay, background, and detection efficiency. Results are presented in digital form for differential and integrated photon number and energy distributions and exposure dose. (auth) (STAR)

414 (N–70-28461) PRELIMINARY DESIGN STUDY FOR A COSMIC X-RAY SPECTROMETER. Clark, George W.; Schnopper, Herbert W. (Massachusetts Inst. of Tech., Cambridge. Center for Space Research). 1969. Contract NAS8-24585. 57p. (NASA-CR–102651). NTIS.

The breadboard spectrometer system is described and the results are given of an evaluation with this spectrometer of different crystals. Results are also presented of theoretical studies made of the optical properties of the spectrometer used with an X-ray telescope, and a preliminary design and analysis of detector systems that can be used with the spectrometer. (auth) (STAR)

415 (N–70-30593) SMALL DIFFERENTIABLE LIQUID SCINTILLATOR NEUTRON SPECTROMETER. Shook, Donald (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). [1970]. 11p. (NASA-TM-X–52828). NTIS.

A liquid scintillator neutron spectrometer utilizing pulse shape discrimination and a two parameter analyzer is described. The problems of determining a neutron spectrum from a measured proton recoil distribution are discussed. By using a small liquid scintillator about ½ inch in diameter by ½ inch long, a good measurement of neutron spectra is obtained using the derivative of the proton recoil distribution. Measurements made with the ½ by ½ NE 218 scintillator for a 5Ci PuBe source show general agreement with better resolution when compared with results for a 2 inch by 2 inch NE 213 scintillator utilizing the ORNL response matrix unfolding technique. Measurements of the resolution of the ½ by ½ NE 218 scintillator give a value of 9% at 2.8 MeV and 5% at 14.7 MeV. These monoenergetic measurements for NE 218 show agreement with the light table for NE 213 measured at ORNL. A comparison is made between the measured and calculated leakage spectrum from a uranyl fluoride-water solution reactor. The ½ by ½ NE 218 measurements show general agreement with the calculation. The resolution of NE 218 is sufficiently good to indicate the effects of scattering resonances in oxygen; valleys at 0.5 and 1 MeV are present in both the measured and calculated spectra. (auth) (STAR)

416 (NBS-TN–523) EXPERIMENTAL TECHNIQUES FOR ELECTRON SCATTERING INVESTIGATIONS. Penner, Samuel (National Bureau of Standards, Washington, D. C.). Apr 1970. 46p. GPO $0.50.

Modern experimental techniques for high energy electron scattering are discussed. Subjects included are: high resolution spectrometer design, the energy loss spectrometer concept, detector ladder systems, beam current monitoring techniques, suppression and measurement of background, the use of on-line computer systems, theoretical considerations and the analysis of data, and 180° scattering. (39 references) (auth)

417 DESIGN, CONSTRUCTION, AND PERFORMANCE OF A FLAT-TYPE MAGNETIC BETA-RAY SPECTROMETER. Gupta, U. C.; Misra, S. C.; Sahoo, H. K. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Pure Appl. Phys.; 6: 354-8(1968).

A flat type magnetic beta ray spectrometer primarily meant for the post-graduate and under-graduate students to familiarize them with the working principle and operation of magnetic beta spectrometers is described. The emphasis in the design of this spectrometer has been mainly on the simplicity of construction and low cost. This spectrometer has a momentum resolution (FWHM) of 1.8 per cent at a transmission 0.03 per cent. Simple experiments such as plotting the momentum distribution of the beta rays, measurement of the energy of the internal conversion electrons, determination of the end point energy of the beta spectrum by drawing FK plot and estimation of the conversion coefficients for some radionuclides can be carried out with this instrument. (auth)

418 POLARIZED NEUTRON SPECTROMETER FOR MAGNETIC SCATTERING STUDIES. Murthy, N. S. Satya; Somanathan, C. S.; Begum, R. J.; Srinivasan, B. S.; Murthy, M. R. L. N. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Pure Appl. Phys.; 7: 546-52(Aug 1969).

The details of construction and operation of a polarized neutron spectrometer, designed and built at Trombay and used at the CIRUS reactor for a number of magnetic scattering studies, is described. The analyzing electromagnet has a variable gap and is capable of providing fields up to 20 kOe. A detailed account of the determination of the various instrumental parameters is also given. The monochromatic polarized neutron flux at the sample position is 5×10^4 n/cm^2/sec, with less than 1% second order contamination. A value of 96% for both the polarizing and flipping efficiencies is achieved. (auth)

419 FORMULA FOR PREDICTING THE SENSITIVITY OF Ge(Li) SPECTROMETERS TO GAMMA RAYS IN THE RANGE 0.4 TO 1.5 MeV. Harvey, J. R. (Berkeley Nuclear Labs., Eng.). Nucl. Instrum. Methods; 86: 189-97(1970).

A formula is developed which gives the full energy peak efficiency of a Ge(Li) spectrometry system to gamma rays. Irradiation geometry and source size and shape can be varied over wide limits. The predictions of the formula agree well with experimental data obtained using detectors with volumes between 0.6 cm^3 and 4 cm^3 exposed to gamma sources with photon energies in the range 0.4–1.5 MeV. (auth)

High Energy Physics Instrumentation

Refer also to abstract 1359.

420 (AD–705505) HIGH-ENERGY ELECTRON-BEAM MONITOR. Crannell, Carol Jo.; Crannell, Hall; Zeman, H. D. (Stanford Univ., Calif. High-Energy Physics Lab.). Nov 1968. Contract Nonr-225(67). 26p. (HEPL–530-Rev-A). NTIS.

Revision of report AD–665585.

A high-energy electron-beam monitor which detects the Cherenkov light emitted in nitrogen gas at atmospheric pressure is described. The monitor is designed to have a constant sensitivity to electrons of energies above 200 MeV, to have a response time of less than 10 to the minus 7th power sec, and to have a current output which is linearly proportional to the beam intensity over a range of 5 decades. The results of tests made on the monitor are presented. The tests show that the monitor has a sensitivity, speed, range, and lack of dependence on beam position and background radiation which make it ideal for many monitoring applications. (auth) (USGRDR)

421 (ITEF–734) SYSTEM OF HEAT-EXCHANGE AND THERMOSTABILIZATION FOR THE 2-METER LIQUID-HYDROGEN BUBBLE CHAMBER OF THE ITEF. Kiselevich, I. L.; Moskalev, V. I.; Pletnikov, A. A.; Ruzin, M. N.; Schwarzman, B. F.; Shkarlet, V. D. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1969. 12p. (In Russian). Dep. NTIS (U. S. Sales Only).

The heat-exchange and thermostabilization system of ITEP 2-metre liquid-hydrogen bubble chamber is described. The system provides a uniform temperature distribution and keeps the temperature constant within the chamber volume up to 0.1°. (auth)

422 (JINR–P1-5357) METHOD OF DETERMINING THE ELECTRON AND POSITRON TRACK PARAMETERS TAKING INTO ACCOUNT THE RADIATIVE LOSSES. Kerachev, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1970. 19p. (In Russian). Dep. NTIS (U. S. Sales Only).

An algorithm is described for calculation of the electron tracks in a 2-meter propane bubble chamber, taking into account the radiative losses. The results are presented of processing the experimental and generated tracks using the computer with the program composed on the basis of this algorithm. (auth)

423 (UCRL–19842) REVIEW OF THE MAJOR PROBLEMS ENCOUNTERED DURING TEN YEARS OF OPERATING A LARGE SCIENTIFIC COMPUTING SYSTEM. Osborne, Carol F. (California Univ., Berkeley. Lawrence Radiation Lab.). 22 Jun 1970. Contract W-7405-eng-48. 6p. (CONF-700917–1). Dep. NTIS.

From Conference on Automation of Scientific Researches on the Computer Base, Novosibirsk, USSR.

The Lawrence Radiation Laboratory, Berkeley, California has an automatic film scanning device attached on-line to an IBM 7094 II computer. The system monitor is multiprogrammed to coordinate computer use between three levels of priority: 1) realtime automatic scanning of bubble chamber film, 2) processing of the scanned data, and 3) batch processing of other analysis programs. Bubble chamber events are processed, completely automatically, at the rate of 150 per hour. Operational problems encountered in growing to 500,000 events per year are discussed. These can be categorized as follows: 1) people and machine problems in manual (or semi-automatic) scanning, 2) maintaining communications between operating staff and programmers, 3) restart and recovery procedures, 4) quality control, 5) hardware problems, 6) time and event accounting procedures, and 7) data summarization. (auth)

424 (UH–511-83-70) PROPORTIONAL QUANTAMETER FOR THE 15-FOOT BUBBLE CHAMBER. Yount, D. (Hawaii Univ., Honolulu). 23 Jul 1970. 19p. Dep. NTIS.

The performance of a proportional quantameter to detect and

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measure the energy of the neutral pions produced by neutrino interactions in the 15-foot bubble chamber is evaluated. The total energy is determined from the sum of a number of wire outputs, while spatial resolution is obtained by reading out other wire planes individually. (auth)

425 GRAVITATIONAL WAVE DETECTOR WITH SUPERCONDUCTING RESONANCE ELEMENT. Lavrent'ev, G. Ya. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekh. Fiz., 39: 1316-20(July 1969). (In Russian).

The question of the recording of gravitational radiation of low and high frequency is considered. A calculation of a gravitational wave detector with a high-quality-factor superconducting resonance element (with two modes of operation) is given. The possibility is shown of the increase of the initial displacement of the sensitive element of the resonator. In the first mode according to given estimates it is possible to hope for the recording of a flow of energy of $t \simeq 10^{-7}$ erg/cm^2 (sec) for a frequency of 10^{-3} sec^{-1} and $t \simeq 10^{-16}$ erg/cm^2 (sec) for a frequency of 10^3 sec^{-1}. For work in the second mode the use of certain statistical methods of isolation of the weak signal from the background can increase the sensitivity to 4th order. (tr-auth)

426 STUDY OF THE TRACK PROFILE OF RELATIVISTIC PARTICLES IN A PHOTOGRAPHIC EMULSION. Sandor, L.; Tucek, J. (Safarik Univ., Kosice, Czech.). Fyz. Cas.; 19: 139-47(1969).

The structure of a relativistic particle track in a nuclear emulsion has been studied, i.e., the distribution with respect to the track axis of the edges of grains forming the particle track. Nuclear emulsions of the NIKFI-R type have been used, irradiated by 2 GeV and 9 GeV protons from the internal beam of the JINR synchrophasotron at Dubna. The mean square value of the distribution of grain edges with respect to the track axis has been found to be practically the same for both proton energies. On the other hand, the density of "excesses," i.e., of grain edges at distances from track axis greater than a multiple of the mean square value of the distribution, depends on the particle energy and can be used for identification of relativistic particles; it is due predominantly to the presence of δ-electrons. The method of experimental determination of this parameter is analogous to measurements of δ-electron density "by the effective range" but it is less influenced by subjective features. (NSA of Czech.)

427 SCATTERING FACTOR IN NUCLEAR EMULSIONS. Sood, P. M. (Panjab Univ., Chandigarh, India). Indian J. Pure Appl. Phys.; 6: 645-6(1968).

The value of scattering factor (K) has been determined by the "angular dispersion method" and the "tangent angle method." The weighted average value of K by the tangent angle method for cell lengths of 3, 4, and 8 cm is found to be 25.7 ± 1.6, thus indicating that the value of K at cell lengths $t \geq 1$ cm is lower than the theoretical expectations. The results by the angular dispersion method depict the same trend. (auth)

428 METHOD FOR ELECTRON–PHOTON CASCADE ENERGY MEASUREMENTS BY PHOTOMETRY OF DENSITIES IN X-RAY FILMS. Baradzei, L. T.; Kanevskaya, E. A.; Smorodin, Yu. A. Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 200-11(1970). (In Russian).

Descriptions are given of the operation technology with x-ray film RT-6 used for recording electron-photon high-energy cascades. The criteria for selecting optical density spots of electron-photon cascades on the background of x-ray films were formulated. A method suggested for measuring electron-photon cascades by photometric selection of density spots was used for measuring cascade energy with an incidental error of 30%. The method is suitable for the cascade energy exceeding 6×10^{11} eV. Fluctuations caused by cascade development are taken into account. The method was compared with the method of energy determination by counting electrons in nuclear emulsions. (R.V.J.)

429 INSTALLATION FOR STUDYING WIDE ATMOSPHERIC SHOWERS AND NUCLEAR INTERACTIONS OF PARTICLES OF COSMIC RADIATION AT 10^{13} TO 10^{16} eV ENERGIES. Amineva, T. P.; Aseikin, V. S.; Vavilov, Yu. N.; (and others). Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 157-76(1970). (In Russian).

Descriptions are given of a Tyan'-Shan' complex installation designed for studies of wide atmospheric showers with the primary energy of 10^{13} to 10^{16} eV, and for nuclear-active high-energy particles and muons. The installation consisted of two-ionization calorimeters, detectors for Cherenkov radiation from the atmosphere, large number of scintillation and gas discharge counters, neutron monitors, and spark chambers. All information except that of the spark chamber, was recorded on a double code narrow magnetic ribbon used for direct programming in a computer. (tr-auth)

430 HIGH SPATIAL RESOLUTION PROPORTIONAL CHAMBERS. Atac, M.; Lach, J. (National Accelerator Lab., Batavia, Ill.). Nucl. Instrum. Methods; 86: 173-6(1970).

Multiwire proportional chambers with 1 mm wire spacing have been built at National Accelerator Laboratory and tested at Argonne National Laboratory in a spatially separated beam of 2.1 GeV/c π^+. At 1 atm pressure using 10% methane and 90% argon gas mixture with 3 mm gap the detection efficiency approaches 100%. The measured transit time of the primary electrons is less than 10 nsec with this spacing. The pressure dependence of the proportional pulses was investigated. At one atmosphere the width of the time distribution is 34 nsec at fwhm and very much broadened at higher pressures. We find that a spatial resolution of ±0.5 mm was reached. We believe even higher resolutions may be obtainable. A chamber of this type is capable of counting above 10^6 pulses per wire per second, provide good timing information, be capable of operation in magnetic fields, and provide high multiparticle detection efficiencies. (auth)

431 ADAPTIVE DATA COMPRESSION METHOD FOR A COSMIC RAY EXPERIMENT ON BOARD A SPACE PROBE. Green, G.; Hasler, H. G.; Kunow, H. (Univ., Kiel). Nucl. Instrum. Methods; 86: 213-16(1970).

A method is described which makes optimal use of a limited telemetry capacity available for a cosmic ray experiment on board a space probe. The counting rates of a group of scalers are effectively compressed in two steps. In the first step, each counting rate is compressed individually by a square root method. In the second step, a group of counting rates is further subjected to a collective compression. In addition to the counting rates, the detector system generates bit combinations for randomly selected single particle penetrations which contain detailed information about detector pulse heights. These so-called pulse height words are transmitted together with the compressed counting rates in the experiment data frame. The procedure is adaptive in the sense that during enhanced solar activity a major part of the bit rate will be used for the transmission of counting rates. During quiet interplanetary conditions a major part of the bit rate is assigned to pulse height words. There is no special switching mechanism necessary in order to distinguish between these different interplanetary conditions. (auth)

432 BUBBLE CHAMBER HOLOGRAPHY. Withrington, R. J. (Imperial Coll. of Science and Tech., London). pp 267-78 of Engineering Uses of Holography. /Robertson, Elliot R. (ed.). Cambridge, Eng.; Cambridge University Press (1970).

From Symposium on the Engineering Uses of Holography, Glasgow, Scotland. See CONF-680978.

A report of experiments being carried out to obtain adequate depth of focus in future bubble chambers with a depth of up to 4 m is given. A mock bubble chamber was constructed containing 500 μm bubbles and two beam holograms were made of the "bubble" images illuminated using scotchlite and seen through a lens with a demagnification of 25. In such a system, tracks in central planes of the chamber form sharply focused images on the film, while tracks in the edge planes form hologrammed out-of-focus images. The precise location of the out-of-focus images can then be found on reconstruction. The problem of obtaining adequate contrast in the reconstructed images to allow accurate position measurement is being investigated and some experimental results are reported. (auth)

433 EXPERIMENTAL LONG COHERENCE LASER FOR BUBBLE CHAMBER HOLOGRAPHY. Watts, J. K. (Imperial Coll. of Science and Tech., London). pp 279-87 of Engineering Uses of Holography. /Robertson, Elliot R. (ed.). Cambridge, Eng.; Cambridge University Press (1970).

From Symposium on the Engineering Uses of Holography, Glasgow, Scotland. See CONF-680978.

The factors concerning the choice of a suitable laser source for holographic recording of nuclear bubble chamber tracks are discussed. The experimental details of the equipment constructed as a test are described, together with measurements of the performance by a direct method of long path-difference interference giving the coherence length. (auth) (UK)

434 SEVERAL PROBLEMS IN IN-LINE FRAUNHOFER HOLOGRAPHY FOR BUBBLE-CHAMBER TRACK RECORDING. Murata, Kazumi; Fujiwara, Hirofumi; Asakura, Toshimitsu (Hokkaido Univ., Sapporo). pp 289-300 of Engineering Uses of Holography. /Robertson, Elliot R. (ed.). Cambridge, Eng.; Cambridge University Press (1970).

From Symposium on the Engineering Uses of Holography, Glasgow, Scotland. See CONF-680978.

The use of in-line Fraunhofer holography for recording bubble-chamber tracks was investigated using simulated conditions of

a bubble chamber. Optical spatial filtering based on the double diffraction method is combined with the recording and reconstruction processes of bubble-chamber holography in order to suppress undesirable beam tracks. Some of the parameters, such as coherence of the source used, filtering effects, resolution, and three-dimensional reconstruction are examined. Finally, the actual bubble-chamber photographs are used as the objects and the results of the holographic processing for them show satisfactory promise of success for applying in-line filtered holography to the recording of bubble-chamber tracks. (auth) (UK)

435 REFRIGERATION ASPECT OF THE ANL 12-FOOT BUBBLE CHAMBER SUPERCONDUCTING-MAGNET SYSTEM. Vander Arend, P. C. (Cryogenic Consultants, Inc., Allentown, Pa.). Advan. Cryog. Eng.; 15: 150-7(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The design criteria, refrigeration requirements, system description, system features and safety considerations of the superconducting-magnet system for the ANL 12-foot bubble chamber are described. (M.H.R.)

436 EXPLANATION OF THE PROCESS OF IONIZATION RESPONSIBLE FOR LATENT IMAGE FORMATION ON THE BASIS OF RECOMBINATION OF POSITIVE HOLES AND ELECTRONS IN NUCLEAR EMULSIONS. Sharma, A. P.; Gaur, R. K. (Kurukshetra Univ., India). Indian J. Pure Appl. Phys.; 7: 325-9(May 1969).

An attempt has been made to explain the process of ionization responsible for latent image formation on the basis of the theory of recombination of positive holes with electrons outlined by J. W. Mitchell and N. F. Mott [Rep. Progr. Phys., 20 (1957), 433; Phil. Mag., 2 (1957), 1149]. It is shown that the recombination process reduces the number of positive holes created due to an energy loss in a grain and the remaining effective number of holes is utilized for latent image formation. The calculated value of effective ionization agrees well with the experimental results. The experimentally observed variation of the grain density with specific energy loss has also been explained on the basis of the recombination process. (auth)

Radiation Dosimeters

Refer also to abstracts 44, 370, 784, and 1284.

437 (HASL-236) DOSIMETRY STUDY OF THERMALLY STIMULATED EXOELECTRON EMISSION (TSEE) WITH LITHIUM FLUORIDE. Burke, Gail de P.; Beck, Harold L. (New York Operations Office (AEC), N. Y. Health and Safety Lab.). Aug 1970. 19p. Dep. NTIS.

In an effort to find a precise and practical radiation dosimetry technique for personnel, low level, and background monitoring, we have investigated the phenomenon of thermally stimulated exoelectron emission (TSEE) in lithium fluoride. The feasibility of assembling a workable TSEE readout system from standard laboratory equipment has been tested and some TSEE properties of LiF powder dosimeters have been studied. A description of the apparatus used and experimental results are presented. Both the net exoelectron emission counts and the peak height (exoelectron emission count rate at the peak maxima) from lithium fluoride powder vary linearly with dose from about 100 mR to 100 R, and the powder has a sensitivity of 800 counts per roentgen with a 9 millimeter diameter dosimeter. (auth)

438 (NP-18481) DIELECTRIC ALKANE–CARBON TETRACHLORIDE MIXTURES UNDER X AND GAMMA IRRADIATION: APPLICATION TO X-RAY DOSIMETRY. Lapeyre, Michel (Toulouse Univ. (France). Faculte des Sciences). 1970. 95p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis.

Binary alkane-carbon tetrachloride mixtures show an inhibition effect for the ionization current under ^{60}Co γ radiation. Viscosity measurements of liquids subjected to electric field indicate that this decrease is not due to electrostatic interactions. Carbon tetrachloride appears to be an electron scavenger. The 2,2,4-trimethyl pentane–5,7% carbon tetrachloride mixture is equivalent in dosimetry to the soft tissue for x and γ radiation energies from 20 keV to 10 keV. The curve of ionization current for the same exposure rate as a function of energy is linear in this energy range. (France)

439 USE OF RELAXOMETERS FOR REACTOR RADIATION CALORIMETRY. Briskman, B. A.; Bondarev, V. D.; Matveev, Yu. V.; Novgorodtsev, R. B. This paper was summarized in At. Energ. (USSR); 27: 50(Jul 1969) as paper No. 316/5113. (In Russian).

A new method for determining the composition of absorbed doses is the relaxometer method, which is based on differences between the linear attenuation coefficients for individual types of radiation in the chosen material. It has been shown that, since the shape of the temperature field in a data unit of a given geometry depends on the exponent of the attenuation curve, analysis of the temperature field also makes it possible to obtain data on the absorbed dose composition. Polyethylene was used as the data unit material (a rectangular parallelepiped with a length of 150 mm and 5 × 5-cm cross section). It is shown that, for absorbed doses of gamma radiation from a water-cooled, water-moderated reactor, the linear dose attenuation coefficient is $\mu_\gamma = 7.0\ m^{-1}$, while, for fast neutrons of the same spectrum, this value is $\mu_n = 20\ m^{-1}$ (for polyethylene). These values were used for calculating the temperature fields in the relaxometer's data unit, which made it possible to define a number relating the type of the temperature field to the dose composition. (W.H.K.)

440 THERMOLUMINESCENCE DOSIMETRY WITH NATURAL CALCIUM FLUORIDE POWDER. Nambi, K. S. V.; Sunta, C. M. (Bhabha Atomic Research Centre, Bombay). Indian J. Pure Appl. Phys.; 6: 294-8(1968).

The development of a radiation dosimeter using the thermoluminescent property of natural calcium fluoride is described. The dosimeter consists of a kanthal strip on which a thin layer of thermoluminescent calcium fluoride is deposited by means of a resin. It is heated by passing 30 amp of current through the kanthal strip for half a minute and the thermoluminescence glow emitted is a measure of the radiation exposure received by the dosimeter. A photomultiplier tube coupled with an electrometer dc amplifier and recorder is used to measure and record the glow peaks. At Trombay this natural calcium fluoride thermoluminescence dosimetry system is being used for a number of purposes such as mapping of the radiation fields inside gamma garden, exposure measurements from irradiated reactor fuel, dosimetry in seed irradiation experiments and in personnel dosimetry. Some results of these applications are presented. (auth)

441 GAMMA DOSIMETRY DOWN TO 2 RADS AND LOW NEUTRON FLUX MEASUREMENTS BY THE $FeSO_4$–HCOOH–$H_3{}^{10}BO_3$ SYSTEM. Faucitano, Antonio; Faucitano Martinotti, Fausta; Maxia, Vera (Univ., Pavia, Italy). Ric. Sci.; 39: 782-8 (Oct-Dec 1969). (In Italian).

The experimental conditions for the use of $FeSO_4$–HCOOH and $FeSO_4$–HCOOH–$H_3{}^{10}BO_3$ systems in low γ doses and low neutron fluxes measurements were determined. Formic acid at a concentration of 0.3M enhances the $G(Fe^{3+})$ values for γ and α Li radiations from 15.6 to 285 and from 4.22 to 45, respectively. Air-saturated solutions of 10^{-3}M $FeSO_4$ and 0.3M HCCOH in 0.8N H_2SO_4 are suitable for measuring γ doses in the range 2 to 40 rads with air-saturated solutions of 10^{-3}M $FeSO_4$, 0.3M HCCOH, and 0.35M $H_3{}^{10}BO_3$, in H_2SO_4 0.8N H_2SO_4 measurements of neutron fluxes of about 3×10^{-4} n cm^{-2} s^{-1} were made. (auth)

442 IMPROVEMENTS IN OR RELATING TO EQUIPMENT FOR THERMOLUMINESCENT DOSIMETRY. Perry, Kenneth Edward Gordon (to United Kingdom Atomic Energy Authority). British Patent 1,203,780. 3 Sep 1970. Filed 21 Dec 1967.

Readout equipment for heating thermoluminescent dosimetric material and measuring the light emission is described which comprises a light-proof casing with support means for the thermoluminescent material, and contains a photoelectric transducer and electrical heater. The thermoluminescent material is introduced in pellet form, instead of the more usual powder form. (UK)

443 PROPERTIES OF A NEW RPL DOSIMETER IN NUCLEAR EMERGENCIES. Schmidt, Th.; Pfister, H. (Univ., Erlangen-Nuernberg, Ger.). Atompraxis; 16: 264-9(Jul-Aug 1970). (In German).

The properties and performance of a radiophotoluminescence dosimeter designed for use in cases of nuclear emergencies are described. It allows the measurement of a dose between 20 R and 1000 R with an accuracy of ±10% quite independent of the energy of X- or γ-radiation above 80 keV including 17 MeV-electrons. Before the measurement, it is necessary to keep the glass about half an hour in boiling water in order to obtain the total dose. There is no fading at room or body temperatures. (auth)

444 MONITORING OF PERSONNEL NEUTRON DOSES BY COUNTING OF FISSION-FRAGMENT TRACKS IN CERTAIN PLASTICS. Pretre, S. B. (Institut Federal de Recherches en Matiere de Reacteurs, Wuerenlingen, Switzerland). Radiat. Eff.; 5: 103-10(Aug 1970). (In French).

A neutron dosimeter is described which is at present being worn by personnel of the Nuclear Research Center, Würenlingen (Switzerland). This dosimeter allows the measurement of routine as

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well as accidental doses. It contains two detectors, each of which is composed of a fission metal disc in contact with a plastic foil ("Lexan"). For the fast neutron detector the metal used is ^{232}Th and for the thermal neutron detector it is an alloy of Al–^{235}U. Neutrons induce fission in the metals. Some of the fragments penetrate into the plastic foils, thereby producing tracks which can be developed in a KOH solution and then visualized under the optical microscope. Neutron doses are directly proportional to track densities. (auth)

445 OBSERVATION OF THERMOLUMINESCENCE INDUCED BY FISSION FRAGMENTS. Ettinger, K. V.; Durrani, S. A.; Christodoulides, C. (Birmingham Univ., Eng.). Radiat. Eff.; 5: 99-102(Aug 1970).

Thermoluminescence (TL) induced in CaF_2 powder by fission fragments emanating from a uranium foil bombarded by fast neutrons has been measured as a function of neutron fluence. A linear relationship between the glow produced and the fast neutron fluence between 5×10^{10} and 6.5×10^{11} n/cm^2 has been obtained, thus establishing the feasibility of the use of this method for fast-neutron dosimetry. A limitation of the method is that, if the fissile foil is not separated from the phosphor after irradiation, the TL produced by the α-disintegration of ^{235}U may eventually mask the fission-induced TL. (auth)

446 VARIATION OF RESPONSE OF THE $FeSO_4$ DOSEMETER WITH TEMPERATURE OF THE SOLUTION DURING IRRADIATION. Law, J. (Royal Infirmary, Edinburgh). Phys. Med. Biol.; 15: 741-2(Oct 1970).

A temperature coefficient for the oxidation of the $FeSO_4$ dosimeter was measured using ^{60}Co to irradiate $FeSO_4$ solution in glass vessels. Experimental details are given. Twenty-four irradiations, in 3 sets of 8, were performed at each of three groups of temperatures. The results showed an average temperature coefficient of 0.18 ± 0.04% per °C from 8 to 20°C, and 0.06 ± 0.02% per °C from 20 to 40°C. When a graph is drawn through the three groups of points, its slope between 20 and 25°C indicates a coefficient of 0.10 ± 0.03% in good agreement with previously reported values. (UK)

447 METHOD FOR ANNEALING LITHIUM FLUORIDE TEFLON DISCS. Docherty, J.; Marshall, M. (Atomic Energy Research Establishment, Harwell, Eng.). Phys. Med. Biol.: 15: 739-40(Oct 1970).

Lithium fluoride thermoluminescent dosimeters require annealing in order to erase all effects due to previous irradiations. A method is described in which at least 50 LiF discs, 1.2 × 0.04 cm, may be annealed in a small tube that occupies little oven space. (auth) (UK)

448 ALKALI HALIDE THERMOLUMINESCENT DOSIMETERS. Mehendru, P. C.; Sootha, G. D.; Kumar, Narendra (National Physical Lab., New Delhi). Radiat. Eff.; 4: 185-8 (Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Single crystals of KCl–Ca were studied as thermoluminescent dosimeters for the measurement of x radiations from Cu and Mo targets in the range of 5 mR to 50,000 R. Depending upon the amount of radiations received by these crystals, thermoluminescence peaks at 85, 35, and 190°C are observed for a heating rate of 40°C/min. The total area under the thermoluminescence curve is observed to be directly proportional to the amount of radiations received by these crystals. The effect of the lag of time between the exposure to radiations and the heating for thermoluminescence has also been studied. (auth)

449 RADIATION DOSIMETER USING PEROXY RADICALS IN IRRADIATED POLYTETRAFLUOROETHYLENE. Tamura, Naoyuki; Oshima, Yunosuke; Yotsumoto, Keiichi; Sunaga, Hiromi (Japan Atomic Energy Research Inst., Takasaki). Jap. J. Appl. Phys.; 9: 1148-53(Sep 1970).

A new method of radiation dosimetry using peroxy radicals in irradiated polytetrafluoroethylene (PTFE) has been developed. The PTFE used is in powder form. The results show that this dosimeter is useful for both electron and ^{60}Co gamma-ray irradiation. The concentration of the peroxy radicals linearly increases with dose up to 100 Mrads and does not depend on the dose-rate. The peroxy radicals formed by irradiation are stable during prolonged storage, and handling of the sample is easy. The behavior of the peroxy radicals in the irradiated PTFE is discussed. (auth)

450 DOSIMETRY AND SPECTROMETRY OF FISSION AND THERMONUCLEAR NEUTRONS BY MEANS OF VISUAL PLASTIC DETECTORS. Remy, G.; Ralarosy, J.; Tripier, J.; Debeauvais, M.; Stein, R. (Laboratoire de Physique Corpusculaire, Strasbourg-Cronenbourg, France). Radiat. Eff.; 5: 221-5(Oct 1970). (In French).

Characteristics and the scheme of an individual neutron dosimeter are presented. The principle of the dosimeter is based on (n, f) and (n, α) threshold reaction track visualization in solid-state detectors, especially makrofol and cellulose nitrate. The analysed energy spectra is between the thermal neutron energy and about 20 MeV. (auth)

451 POWDER DOSIMETERS. Walter, Roland; Lehmann, Helmut (to VEB Fluorwerke Dohna). British Patent 1,205,550. 16 Sep 1970. Filed 28 Aug 1969.

An inexpensive dosimeter is described which can conveniently be produced on a large scale and which is of universal applicability, and which also does not run the risk of breakage or being unintentionally opened during use. A polyethylene tube is used, containing particulate thermoluminescent material, with both ends hermetically sealed. The thermoluminescent material may comprise monocrystalline or polycrystalline LiF, natural CaF_2, $Li_2B_4O_7$/Mn, CaF_2/Mn, or $CaSO_4$/Mn. A process for the production of such dosimeters is described. By variation of the tube dimensions and the quantity and nature of the thermoluminescent material, these dosimeters can be adapted to various fields of use. (UK)

452 METHOD FOR MEASUREMENT OF THE MIXED GAMMA-NEUTRON RADIATION DOSE EQUIVALENT AND AN ARRANGEMENT FOR THE APPLICATION OF THIS METHOD. (to Instytut Badan Jadrowych). British Patent 1,203,609. 26 Aug 1970. Priority date 23 Dec 1966, Poland.

A scintillation detector with a response linearly related to the quality factor is placed inside an ionization chamber with a response that is proportional to the absorbed dose rate. An electrometer measures the difference in voltage of the two detectors from which the dose equivalent is determined. (W.H.K.)

Radiometric Instruments

Refer also to abstracts 273 and 458.

453 AUTOMATIC DEVICE FOR MONITORING RADIOACTIVE DEPTH MARKS OF LOGGING CABLES. Zboril, A.; Mares, S. (Charles Univ., Prague). Geol. Pruzhum; 12: No. 3, 82-4(Mar 1970). (In Czech).

An automatic device for monitoring radioactive depth marks on logging cables is described. The device consists of a radiation detector (6 miniature Geiger–Mueller tubes), placed in a cylindrical annulus embracing the passing cable with the radioactive marks. The detector output is fed to a switching circuit. The voltage pulses corresponding to the cable depth marks are continuously recorded together with the measured logging curves on a film strip by means of light pulses from an electric lamp. The device permits accurate monitoring of cable depth marks within ±6 mm at cable speeds up to 2000 m/hr. With a routine logging technique, two men only are needed for measurement at the boring site instead of the three needed in case of manual recording of the depth marks. (INIS)

454 MOISTURE MEASUREMENT BY NEUTRON MODERATION. Aditya, P. K.; Batra, A. K. (Indian Inst. of Tech., New Delhi). Indian J. Pure Appl. Phys.; 7: 323-5(May 1969).

Using an Am–Be neutron source and a BF_3 counter, nuclear probes have been designed for measuring moisture in soil specimens. The assembly has been found to be capable of distinguishing variation up to 4 g of water per kg of sand. A similar assembly for surface probe could distinguish variations up to 10 g of water per kg of sand. These probes can be used for estimation of moisture in soils, concrete, pavement-cracks, etc., and for industrial applications such as determination of hydrogen content in chemical processes, oil-well logging, etc. (auth)

455 THICKNESS GAUGING USING BACK-SCATTERING OF ELECTRONS. Aditya, P. K.; Batra, A. K. (Indian Inst. of Tech., New Delhi). Indian J. Pure Appl. Phys.; 7: 226-8 (Apr 1969).

Using a ^{90}Sr beta source and an ionization chamber to detect the electrons back-scattered from a thin specimen, it has been found that under suitable geometrical conditions thickness variation as small as 1 mg cm^{-2} of paper can be measured. The advantage of using the back-scattering method for the thickness determination is that only one source of high energy electrons is sufficient. The method is applicable to plastic and metallic foils and to metal coatings. (auth)

456 DETERMINATION OF CONCENTRATION BY AN ABSORPTION METHOD. Hrbek, J. (Inst. of Hydrodynamics,

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Prague); Boucek, J. Strojirenstvi; 20: 295-302(May 1970). (In Czech).

Absorption of γ-radiation was employed to determine the mean concentration of a mixture over the pipeline cross section, and the concentration distribution in individual horizontal layers. In order to determine the change in mean concentration, a concentration change indicator was used equipped with a detection system comprising three GM tubes of an active area of 20 cm^2 each. ^{60}Co and ^{137}Cs were used as gamma sources for the required pipeline wall thickness ranging from 4 to 15 mm at a diameter of 100 to 350 mm. The source activity was 50 to 100 μCi. Two detector arrangements were designed for the measurement of concentration profile, one with ^{60}Co and a scintillation probe with a Frieseke-Höpfner type 49 measuring set, and the other with ^{137}Cs and a new scintillation probe equipped with a FEU-35 photomultiplier. Results are presented of the measurement of concentration changes in the profile of experimental pipeline system JS 180/200 for the following flow rates: 4.18 m/s, 3.28 m/s, and 2 m/s. (INIS)

457 INTERCHANGEABLE FIXED AND PORTABLE COATING THICKNESS MEASURING APPARATUS. Joffe, Boris B.; Fischer, Helmut (to Twin City Testing Corp.). U. S. Patent 3,529,158. 15 Sep 1970. Filed 2 Dec 1966.

A portable measuring head adapted to be hand-carried and held against an object having a coating to be measured can be releasably secured to a fixed stand in position to support such an object. The head carries an object-engaging plate having an exposure aperture which is removable for substitution of a plate having a different exposure aperture, a radiation source holder positioned to transmit radiation through the aperture and a radiation detector including a window receiving radiation backscatter through the aperture. A portable locator having a guide for positioning the locator relative to an object and a base receiving the head for alining the exposure aperture with the object also is provided. In addition, a collar telescopingly receives the head in predetermined angular orientation with the platen and has a surface engaging portion for positioning the head relative to a surface to be measured. (auth)

Miscellaneous Instruments and Components

Refer also to abstracts 216, 317, 1145, 1739, 1878, and 1885.

458 (AAEC/TM-557) INSTRUMENT FOR ANALYSIS OF NATURAL URANIUM SOLUTIONS BY GAMMA ABSORPTIOMETRY. Yates, P. B.; May, J. R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Aug 1970. 20p. Dep. NTIS (U. S. Sales Only).

An assessment is given of a single beam gamma absorptiometer, which uses an americium-241 source, and has been developed for the batch analysis of natural uranium solutions in the range 1 to 400 g U/l. Within the range 10 to 400 g U/l, an accuracy of ±1 per cent was obtained for both aqueous and organic solutions. Within the range 1 to 10 g U/l, the accuracy was ±5 per cent. Design and construction details are given, and the advantages and limitations of the instrument as an analytical tool are discussed. A uranium determination takes less than 5 minutes. Though primarily useful for batch measurements, it can also be used for on-line analytical control. (auth) (Australia)

459 (KFK-1184) SPECIFICATIONS OF THE CAMAC 25-MHz COUNTER MODULE TYPE LEM-52/1.1. Ottes, J.; Tradowsky, K. (Kernforschungszentrum, Karlsruhe (West Germany). Labor fuer Elektronik und Messtechnik). Jun 1970. 15p. (In German). Dep. NTIS (U. S. Sales Only).

The CAMAC counter module may work computer-controlled or with a digital controller. The module has a timer gate and a second gate which is switched on and off manually. The module is one unit wide. It has a 24-bit counting register and one overflow bit which is stored by the digital controller or computer and by the timer for preset count. The CAMAC counter timer system with digital controller or computer will replace the old ESONE counter timer system in the Karlsruhe Nuclear Research Center. (auth)

460 (NP-18408) PROGRESS REPORT [NO.] 13, JANUARY-JUNE 1969. (Institute of Nuclear Sciences, Lower Hutt (New Zealand)). 53p. (INS-388). Dep. CFSTI (U. S. Sales Only).

Progress in nuclear physics research, radiation research, isotope geochemistry (stable isotopes), carbon-14 and carbon-14 variations, isotope applications, and instrument development is outlined. (W.H.K.)

461 (NP-18409) STUDY OF ATMOSPHERIC IONS BY MASS SPECTROMETRY. Alet, Irenee (Toulouse Univ. (France). Faculte des Sciences). 1970. 85p. (In French). Dep. CFSTI (U. S. Sales Only).

Thesis.

An apparatus for the study of ions created at high pressures of 10 to 200 torr was developed. The nature of the positive ions created in atmospheric air at pressures from 10 to 200 torr by a glow discharge or by α irradiation with polonium 210 was investigated. Clustering phenomena revealed in the mobility experiments could be observed. From the ions O_2^+, N_2^+, N_3^+, N_4^+, NO_2^+, H_3O^+ observed for a high ratio E/P, various stable clusters $NO^+(H_2O)_n$, $NO_2^+(H_2O)_n$, $H_3O^+(H_2O)_n$ were formed. The part played by various organic impurities in the clustering phenomena was then studied. (France)

462 (NP-18415) STUDY OF ATMOSPHERIC IONS BY TIME-OF-FLIGHT SPECTROMETRY. Duffa, Georges (Toulouse Univ. (France). Faculte des Sciences). 1970. 48p. (In French). Dep. CFSTI (U. S. Sales Only).

Thesis.

An apparatus for measuring the mobilities of gaseous or radioactive ions by a time of flight method is presented. This system is compared to the Bradbury Nielsen method which is used for measurements. Various experiments were carried out under a variety of atmospheric conditions to measure the mobility evolution of gaseous ions created by β rays, between 10^{-3} and 1 s. The effect of water steam, ultraviolet irradiation and various organic vapors on ion mobility were then investigated. The results obtained were compared to those of experiments made in the same conditions with a mass spectrometer. (France)

463 (UCRL-50892(Vol.4)(Pt.3)) WEAPONS EFFECTS DISPLAY SYSTEM (WEDS MOD II): MAINTENANCE MANUAL. PART 3. LOGIC INTERFACE FALLOUT SYSTEM. Peschel, D. J. (California Univ., Livermore. Lawrence Radiation Lab.). Jul 1970. 156p. Dep. NTIS.

This part of UCRL-50892, Vol. 4, deals with the equipment in the system that generates fallout displays. The digital computer, magnetic disc memory, operator control and readout panels, and logic interface called the memory system controller are described in engineering detail with complete logic schematics. Computer instructions for performing input-output functions are listed. Data input-output word assignments are covered. (auth)

464 (UCRL-50892(Vol.5)) WEAPONS EFFECTS DISPLAY SYSTEM (WEDS MOD II): FALLOUT COMPUTER PROGRAM. Franklin, Paul (California Univ., Livermore. Lawrence Radiation Lab.). 14 Jul 1970. 344p. Dep. NTIS.

The fallout computer program, which was originally developed by Systems Development Corporation and has been modified by the Lawrence Radiation Laboratory, is described. The computer hardware, fallout program organization, fallout data specifications, fallout program details, procedures for changing the program, and complete listings of all fallout software details are given. (auth)

465 LANDING AND ROLL-OUT-AID-USING γ-RAY TECHNIQUES. Bagge, E. (Univ., Kiel); Truemper, F.; Kassner, F.; Busch, K.; Habicht, H. L.; Knaak, J. Luftfahrttech.-Raumfahrttech.; 16: No. 2, 39-42(Feb 1970). (In German).

Present-day ILS systems used as landing aids will, in their present stage, not be suitable for all-weather landing operations under category III C conditions as defined by ICAO. Furthermore, they offer no guidance along the runway nor along the taxiways to the parking area, as would be necessary for landings under category III C. The following report describes a nuclear landing- and roll-out-aid (KLR) which provides accurate guidance also for the last part of the landing phase. The system is based on a gamma-radiation field (^{60}Co, ^{137}Cs) built up along the approach line, the runway and the taxiways. It provides guidance signals for the approach, the landing, and the taxiing up to the parking area, signals which are practically free from any interference. (INIS)

466 PLATE-TO-PLATE EFFECT ON THE DARKENING OF ILFORD Q_2 PLATE AS AN ION DETECTOR IN QUANTITATIVE MASS SPECTROGRAPHY. Grais, Khairi I. (National Research Centre, Cairo). Indian J. Pure Appl. Phys.; 6: 711-12(1968).

An investigation has been made on the darkening of Ilford Q_2S4071 plates as ion detectors, when their surfaces are bombarded with the ion masses $4 \leq M \leq 136$ (a.m.u.) of $^4He^+$, $^{20}Ne^+$, $^{40}A^+$, $^{84}Kr^+$, and $^{136}Xe^+$ having energies 4 and 8 keV. New information has been found on how the darkening of fractional area [(DFA = 1 − T) where T is the transparency] varies with the ion density (n) for constant ion mass (M) and ion energy (E), i.e., $DFA = f(n)_{M,E}$, and when the darkening (D) does not exceed the value 0.155. A relation connect-

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ing the ion density (n) with the ion mass (M), i.e., $n = f(M)_{E,DFA}$, has been established. These relations do not take into account the error due to the plate-to-plate variation which can be minimized only by the standardization of the plates. (auth)

467 DOUBLE FOCUSING SPECTROGRAPH EMPLOYING A ROTATABLE QUADRUPOLE LENS TO MINIMIZE DOPPLER BROADENING. Enge, Harald A.; Smith, Donald L. (to United States Atomic Energy Commission). U. S. Patent 3,524,056. 11 Aug 1970. Filed 5 Jan 1968.

A large-transmission charged-particle spectrographic system having a quadrupole lens rotatable about an axis between a target and a dispersing magnet for producing double-focused images corrected for Doppler broadening by selection of the proper angular position of the quadrupole about the axis is described. (auth)

468 RADIATION OF Hg–^{3}He GAS MIXTURE BOMBARDED BY A NEUTRON STREAM. Andriakhin, V. M.; Vasil'nov, V. V.; Krasil'nikov, S. S.; Pis'mennyi, V. D.; Khvostionov, V. E. (Moscow State Univ.). JETP Lett. (USSR) (Engl. Transl.); 12: 58-9 (20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 83-5(20 Jul 1970).

Lasing radiations were studied from an Hg–^{3}He mixture bombarded by neutrons from a pulsed source with a thermal-neutron flux of about 5×10^{16} neut/cm^{2}sec. The emission signals are briefly discussed. (M.O.W.)

469 INTEGRATING MAGNETOMETER MEASURES SUPERCONDUCTOR CHARACTERISTICS. Powner, E. T.; McKinnon, J. B.; Elce, P. J. (Univ. of Manchester, Eng.). Electron. Eng.; 52-6(Oct 1970).

The magnetometer directly records the magnetization characteristics of a sample of superconductor. Where equipment is required to integrate low-level signals of the order of microvolts over long time periods difficulties arise owing to the presence of noise and drift. (auth) (UK)

470 BASIC THEORY OF MILLISECOND RESPONSE THERMOCOUPLES. Instrum. Pract.; 24: 687-91(Oct 1970).

An analyses showed that the ultra-miniature thermocouples, having the smallest exposed junction available, offer faster temperature measurements than normal thermocouple junctions manufactured with identical materials of larger size. In addition to speed and accuracy, the ultra-miniature thermocouple may also have the advantage of offering a minimum disturbance to the temperature and flow fields of the environment in which they are used. They are available in platinum-platinum rhodium, chromel-alumel, chromel-constantan, and copper-constantan thermocouple pairs. Platinum-rhodium, tantalum, stainless steel, and silver sheath materials are available for use from cryogenic temperatures to 3000°F. They are practically immune to thermal and mechanical shock and their light weight permits ganging and use on rotating elements. Some suggested areas of application are: atomic in-pile instrumentation, rocket fuel temperatures, biophysics, surgery and medicine, shock tube and high speed wind tunnel instrumentation, moulding and casting temperatures, skin temperatures on missile and high speed aircraft, chemical process and industrial controls. (auth) (UK)

471 STAGE AMPLIFIER OF HIGH PERFORMANCE. Barrandon, G. (Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). Nucl. Instrum. Methods; 86: 317-21(1970). (In French).

Owing to the particular design, this high-performance feedback is able to minimize the usual problem of dynamic stability by splitting the amplification into two parallel channels, one being fast and the other slow. (auth)

472 SYSTEM FOR VISULIZATION OF SPECTRA USING A SMALL WIRED-PROGRAM COMPUTER CONNECTED TO THE MEMORY OF A LARGE COMPUTER. Muser, A.; Boetsch, C.; Michaud, J. D.; (and others) (Centre de Recherches Nucleaires, Strasbourg). Nucl. Instrum. Methods; 86 285-90(1970). (In French).

It is interesting to visualize spectra accumulated in the memory of a stored program computer without using the central processing unit and another memory area. This is possible with a small wired program computer which can address the memory of the first one. Such a small computer has been built and connected to an IBM 1800. (auth)

473 ENGINEERING USES OF HOLOGRAPHY. Proceedings and Edited Discussion of a Symposium Held at Glasgow, 17–20 September 1968. Robertson, Elliot R.; Harvey, James M. (eds.). Cambridge, Eng.; Cambridge University Press (1970). 589p. £15. (CONF-680978).

Both the proceedings and edited discussions are presented. An introductory series of papers describing general techniques is followed by papers on particular applications, computer generated holograms, pulsed laser holography, mechanical strains and deformations, holographic photoelasticity, particle size analysis, bubble chamber studies, vibration and movement studies, metrological principles and applications, automatic gauging, microcircuit applications, and acoustic holography. Of the 35 presented papers, three dealing with bubble chamber studies are considered in scope for NSA, and separate abstracts are provided for these. (UK)

For abstracts of individual papers see: 432–434.

474 GEOFIZICHESKAYA APPARATURA. (Geophysical Apparatus). Vikulin, B. K. (ed.). Leningrad; Izdatel'stvo Nedra Leningradskoe Otdelenie (1969). 168p.

Twenty four articles are included on geophysical instrumentation and magneto prospecting. Aspects of future improvements of magnetometers, unification of devices for radioactive probing, integrators with nonlinear compensation, devices for digital recording of analog drill-hole data increased stability of electric-prospecting devices, scintillation counters in thermal radioactive probing devices, and cylindrical scintillation detectors of slow neutrons are described as well as field radiometers and other devices. (R.V.J.)

475 A METHOD AND DEVICE FOR SELECTING PULSES. Robert, Jacques (to Commissariat a l'Energie Atomique). British Patent 1,202,543. 19 Aug 1970. Priority date 5 Oct 1966, France.

A pulse discriminator system which selects pulses of certain amplitude and fall-time constants is described. (W.H.K.)

476 IMPROVEMENTS IN OR RELATING TO MEMORY DEVICES. Dearnaley, Geoffrey (to United Kingdom Atomic Energy Authority). British Patent 1,201,659. 12 Aug 1970. Filed 25 Sep 1967.

The computer memory device described employs a layer of an unsaturated oxide or fluoride that shows a conductivity change under vacuum electron bombardment, this change persisting after bombardment ceases. This layer is mounted on a conducting or semiconducting substrate, together with an electron beam generator the beam of which is caused to scan over the layer. Means are provided for controlling the current density of the beam and also for sensing the effective conductance of the layer. Information is "written" in, "read out" from, or "erased" from the device by appropriately controlling and directing the electron beam at selected discrete areas of the layer; the control means having settings for "moderate" beam current for writing, "low" beam current for "read out", and "high" for erasing. The substrate may take the form of a planar diffused or epitaxial semiconductor junction, with means for making electrical connection across the junction. The unsaturated oxide layer may be composed of SiO and the substrate may comprise layers of n- and p-type Si. (UK)

477 DIGITAL PERIOD METER WITH AUTOMATICALLY CHOSEN OPTIMAL TIME INTERVALS. Staub, F.; Meier, F. (Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen, Switzerland). Neue Tech., B; 11: 68-79(1969). (In German).

This paper describes a digital period meter and a digital period safety instrument. Both instruments work with input signals consisting of a random pulse train. The average pulse rate of these random pulses provides the basis for the calculation of the period. The pulse rate can only be calculated by forming a mean value over a non-vanishing time interval. The instruments mentioned above automatically choose the smallest possible time interval to provide results within fixed standards. This is done with fixed programmed small digital computers. Results are obtained in digital form. (auth)

Radiation Effects on Instruments and Instrument Components

Refer also to abstracts 1261 and 1287.

478 (N-70-27140) COMPATIBILITY AND SHIELDING ANALYSIS OF SCIENCE INSTRUMENTS IN SPACECRAFT CONTAINING A RADIOISOTOPE THERMOELECTRIC GENERATOR. Miller, C. G.; Truscello, V. C. (Jet Propulsion Lab., Pasadena, Calif.). 1 May 1970. Contract NAS7-100. 35p. (NASA-CR-109853; JPL-TR-32-1427). NTIS.

The use of radioisotope thermoelectric generators as a solar-independent power source in spacecraft is considered. The probability of misinterpretation of generator-produced neutron and gamma fields for naturally occurring phenomena by onboard

science instruments is investigated. Spatial deployment and shielding requirements are discussed. Geiger–Mueller tubes, electron multipliers, and silicon surface-barrier detectors are evaluated in detail. Because the sensitivity of the science instruments varies with the energy of the radiation, a 20-group structure in the 0.04 to 10-MeV range was developed to determine the spectral distribution of the radiation energy. Analytic models are developed to predict the effect of these spectra on the instruments selected. The possible degradation of spacecraft electronics is also investigated. The principal findings were that the gamma-photon field does affect the operation of the instruments, while the neutron field does not — either directly or indirectly through capture-gamma production. The age of the fuel is a factor in determining the amount of background interference. The degradation threshold for most electrical components is above the level produced by the fuel. A marginal case exists for injection transistors; methods are proposed for alleviating this condition. (auth) (STAR)

479 (N–70–31746) LITERATURE SEARCH AND RADIATION STUDY ON ELECTRONIC PARTS. Final Report. Horne, W. E. (Boeing Co., Seattle, Wash. Aerospace Group). May 1970. Contracts NAS7-100; JPL-952565. 258p. (NASA-CR–110496; D–2–126203–3). NTIS.

For Jet Propulsion Lab., Pasadena, Calif.

A survey has been made of radiation effects literature pertinent to effects of low-level steady-state neutron, gamma, and proton environments on electronic components. A bibliography of over 300 references was compiled. The data were scanned and an analysis made of the radiation effects state-of-the-art for electronic components on a deep space mission that might be exposed to planetary radiation belts and to on-board radioisotope thermoelectric generator environments. Emphasis was placed on permanent parameter degradation, temporary parameter drifts, parameter degradation factors, hardening techniques, and screening techniques. (auth) (STAR)

480 (N–70–32919) RADIATION INDUCED NONLINEAR DEGRADATION OF TRANSISTOR GAIN. (Boeing Co., Seattle, Wash.). Jul 1970. Contract NAS5-10443. 228p. (NASA-CR–1566; D–2–125680–3). NTIS.

Correlation and equivalence factors of radiation induced nonlinear degradation of transistor current gain were established. A one MeV electron exposure test of transistors was used to empirically formulate aspects of the dependence of nonlinear damage on radiation and to determine the influence of continuous electrical operation during exposure on the magnitude of device damage. Cobalt 60 gamma radiation exposure of devices was extended to high doses to provide improved data on gamma radiation displacement equivalences. Separate electron tests and 15 MeV proton tests were conducted to determine the best test plan approach for combined synergistic tests. Proton testing at 15 MeV was extended to high fluences to further study the importance of ionization effects and to improve displacement equivalence values obtained previously. A statistical study of passive transistors revealed that effects on devices within a batch tend to behave similarly, while devices from separate batches are likely to behave dissimilarly if the batch numbers are very different. (auth) (STAR)

481 (N–70–33998) RADIATION EFFECTS IN SILICON SOLAR CELLS. Quarterly Progress Report, April 1–June 30, 1970. Passenheim, B. C.; Berger, R. A.; Colwell, J. F.; Leadon, R. E.; Naber, J. A. (Gulf General Atomic, Inc., San Diego, Calif.). 10 Jul 1970. Contract JPL-952387. 22p. (NASA-CR-109803; GA–10219). NTIS.

For Jet Propulsion Lab., Pasadena, Calif.

The present effort is concentrated on the study of the effects of lithium on the production and annealing of damage in silicon. This work is being performed on lithium-diffused bulk silicon using measurements such as minority-carrier lifetime, electron-spin resonance (ESR), electrical conductivity, and infrared absorption. The temperature range from 77.5 to 400 K is under investigation. The damage is introduced by 30-MeV electrons and fission neutrons. Thirty-MeV electrons produce defects similar to those produced by high-energy protons. (auth) (STAR)

482 RADIATION EFFECTS IN SILICON SOLAR CELLS. Statler, Richard L. (Naval Research Lab., Washington, D. C.). Radiat. Eff.; 4: 305-11(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Silicon solar cells have been utilized as the principal source of electrical energy for space satellites during the past decade. Despite the reliability of these photovoltaic devices, degradation of their power output by charged-particle radiation in the earth's geomagnetic field has continued to be the primary problem for their use on flights of long duration. A study of radiation damage induced by 1-MeV electrons in a variety of current silicon solar cell types was conducted as a function of dopant impurity and resistivity of the base region. A companion study of radiation damage induced by nominal 0.2-MeV protons was performed in solar cells with coverslips having small cell areas exposed alongside the coverslip. The photovoltaic current–voltage characteristics were measured under a solar simulator emitting 140 mW/cm^2 at air mass zero. Irradiations were performed at room temperature to fluences of 1×10^{16} e/cm^2 and 1×10^{15} p/cm^2. The efficiency of 10 ohm-cm cells after large fluences was superior to cells of 2 ohm-cm base resistivity. No significant differences were observed between boron- and aluminum-doped cells. Solar cell exposure to low-energy protons resulted in an 8% loss in power at a fluence of 1×10^{14} p/cm^2 when as little as 2 percent of the solar cell surface was left unshielded. (auth)

483 EFFECTS OF IMPURITIES ON THE RADIATION DAMAGE AND ANNEALING BEHAVIOR OF Si SOLAR CELLS. Usami, Akira (Nagoya Inst. of Tech., Japan). Jap. J. Appl. Phys.; 9: 1063-9(Sep 1970).

The reduction of minority carrier lifetime by γ-irradiation is strongly dependent on the sample type P/N or N/P, and the effect of chemical impurities such as Cu and Ni on radiation resistance is more remarkable in N/P-type than in P/N-type samples. Introduction rate of defects for P/N and N/P-type cells contaminated with impurities decreases to about $1/2$ and $1/7$ of non-contaminated cells, respectively. In N/P-type cells, the increase in short-circuit current under γ-irradiation is observed, and is due to an improvement of V–I characteristics. The isochronal annealing behavior of cells is also strongly dependent on the sample type. Annealing temperature for P/N-type cells contaminated with chemical impurity is lower than that for non-contaminated P/N-type. Impurity-contaminated cells showed a remarkable increase in unannealed fraction of short-circuit current over the temperature range of 180 to 200°C. For N/P-type cells, an abrupt increase in unannealed fraction is observed at about 120°C for both Cu-contaminated and non-contaminated cells. (auth)

484 VOLT–AMPERE CHARACTERISTICS OF TUNNEL p–n JUNCTIONS IN GALLIUM ARSENIDE IRRADIATED BY FAST NEUTRONS. Alekseeva, Z. M.; Brudnyi, V. N.; Krivov, M. A.; Malyanov, S. V.; Khomchuk, O. N. (Tomsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 3, 146-9(1970). (In Russian).

Gallium arsenide diodes were prepared by alloying in vacuum with zinc up to a charge carrier concentration of 5 to 6×10^{19} per cm^3 at various fusion temperatures (500, 550, 600, and 650°C). The diodes were given a neutron dose of 1×10^{18} neutrons/cm^2 at a temperature of 70°C. Measurements of volt-ampere characteristics were carried out at constant current at temperatures of 300 and 80°K. A steady increase in excess current is observed with increasing neutron dose. The increase in excess current with increasing direct bias is almost exponential, and can be explained by a homogeneous distribution of defects in the forbidden zone. An isothermal annealing leads to a partial annealing of defects induced by gamma irradiation. Diodes obtained at the higher fusion temperatures possessed the greatest radiation stability. (TTT)

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LIFE SCIENCES

Biochemistry, Physiology, and Molecular Biology

Basic Processes

Refer also to abstracts 375, 540, and 559.

485 RED CELL EQUILIBRATION IN LIVER TISSUE DURING EXPERIMENTAL SHOCK. James, Norman J.; Matsuda, Takayoshi; Shoemaker, William C. (Mount Sinai School of Medicine, New York. Cook County Hospital, Chicago). Ann. Surg.; 172: 109-15(Jul 1970).

Changes of red cell concentration in hepatic tissue and in equilibration of tissue red cells with circulating red cells in dogs were observed before and after hemorrhagic shock produced by the Wiggers' technic. Diisopropylfluorphosphate-^{32}P (^{32}DFP) labeled red cells were given in the control period and ^{51}Cr labeled cells were given at intervals after hemorrhage and reinfusion of the shed blood. There was an increase in the concentration of liver red cells and incomplete equilibration of tissue red cells with circulating red cells after hemorrhagic shock. The proportion of cells that failed to equilibrate did not change appreciably during the period of observation after reinfusion of the shed blood. Although the percentage of the slowly equilibrating red cells in the liver tissue was appreciable, the actual volume was relatively small. (auth)

486 CHANGES OF THE APPARENT ^{3}HOH, ^{82}Br, ^{125}I HUMAN ALBUMIN, AND ^{51}Cr RED BLOOD CELL DILUTION VOLUMES BEFORE, DURING, AND AFTER OPERATION IN HUMAN SUBJECTS. Kragelund, Ebbe (Gentofte Hospital, Copenhagen. Kommunehospitalet, Copenhagen). Ann. Surg.; 172: 116-24(Jul 1970).

Operative and postoperative changes of ^{3}HOH, ^{82}Br, ^{125}I-human albumin and ^{51}Cr-red cell volumes were estimated by tracer dilution kinetics in 16 patients undergoing major abdominal operations. Both ^{3}HOH and ^{82}Br apparent volumes increased in similar fashion during and after operation. It is supposed that a considerable amount of endogenous water was produced and that most of the endogenous water and excess fluid intake was retained in the body during and after operation. ^{82}Br volume was more constant pre- than postoperatively, fluctuating about ±8%. No significant changes of plasma volume were found a short time after operation. Excretion of ^{125}I in gastric juice increased after operation. This ^{125}I was reabsorbed in the small intestines and possibly excreted in the urine. A tendency towards decreased red cell volume was seen in the postoperative period possibly caused by shrinking of erythrocytes after infusions of slightly hypertonic solutions. (auth)

487 SIMULTANEOUS STUDY OF THE ABSORPTION OF TRITIATED PTEROYLGLUTAMIC ACID AND ^{60}Co-VITAMIN B_{12}. Musso, A. M.; Kremenchuzky, S.; Rochna, E. M. (Hospital Escuela Jose de San Martin, Buenos Aires. Comision Nacional de Energia Atomica, Buenos Aires. St. Bartholomew's Hospital Medical Coll., London). J. Nucl. Med.; 11: 569-75(Oct 1970).

A method for the simultaneous study of the absorption of tritiated pteroylglutamic acid (^{3}H-PGA) and ^{60}Co-vitamin B_{12} is presented. The procedure consists of measuring the unabsorbed radioactivity by collecting and counting the feces after the administration of a single, combined oral dose of the labeled vitamins. The accuracy of the method for simultaneously counting of ^{3}H and ^{60}Co in feces, by means of a liquid scintillation spectrometer, was assessed and proved to be satisfactory. Simultaneous tests were performed in control subjects, patients with chronic atrophic gastritis and patients with megaloblastic anemia. The results of these tests are discussed. The major advantage of this simultaneous method is that it gives a quantitative estimate of the absorption of two metabolically related compounds at the same point in time and under defined conditions. The method allows the study of the patient's response to specific therapeutic trials. A computer program processes the results from this method in an accurate and rapid manner. (auth)

Metabolism, Physiology, and Toxicology

Refer also to abstracts 511 and 642.

488 (UCRL-72636) FATE OF FALLOUT INGESTED BY LIVESTOCK. I. DAIRY COWS. Potter, Gilbert D.; Vattuone, G. M.; McIntyre, D. R. (California Univ., Livermore. Lawrence Radiation Lab.). 11 Aug 1970. 16p. (CONF-700909-2). Dep. NTIS.

From Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War, Upton, N. Y.

The fate of fallout ingested by livestock—its retention, absorption from the gut, deposition in tissues, and transport to man—are of direct concern when considering survival of livestock and ingestion of their byproducts by man in the event of a nuclear war. The data presented here are from two cows fed debris from a nuclear cratering event. The first of these was given a single dose of debris while the second received a daily administration of debris. The γ-emitting radionuclides observed in milk were ^{131}I, ^{132}Te, ^{140}Ba, ^{181}W, ^{187}W, and ^{189}W/^{189}Re, and in urine: ^{74}As, ^{103}Ru, ^{131}I, ^{132}Te, ^{181}W, ^{187}W, and ^{189}W/^{189}Re. Maternal and fetal tissues in the second cow were analyzed for γ-emitting radionuclides and compared to the maternal plasma levels of these nuclides. Maternal kidney, liver, and spleen concentrated ^{74}As while fetal tissues had none. Both maternal and fetal thyroids concentrated ^{131}I by 10^{5} over maternal plasma. Fetal bone was the primary target organ for ^{140}Ba. The radiotungstens were concentrated by fetal bone and by maternal kidney, liver, spleen, and bone. Elimination patterns of the nonabsorbed radionuclides from debris are also presented. (auth)

489 STUDIES ON THE GERMINATION OF PINE POLLEN (PINUS MUGO) IN VITRO. II. EFFECTS OF DIFFERENT IONS. Nygaard, P. (Inst. of Biological Chemistry B, Copenhagen). Physiol. Plant.; 23: 372-84(1970).

Studies on the initial germination of pollen of Pinus mugo showed no significant influence of ions on O_2 uptake and uptake of ^{32}P-labelled phosphate. At the onset of tube growth O_2 uptake decreased in the absence of calcium. In inorganic media tube growth and ^{32}P uptake were reduced in the absence of calcium or boric acid. In the absence of calcium a requirement for magnesium was observed. When the medium was deprived of polyvalent ions with EDTA, growth and ^{32}P uptake ceased. The presence of calcium in the medium was found to be essential for the maintenance of the structural and functional integrity of cell membrane. The ion requirement was more pronounced when tube growth was stimulated with sucrose. Calcium, magnesium, boric acid, and nitrate (as nitrogen source) were essential constituents of the medium. The stimulation due to calcium required either magnesium or boric acid. A density effect was observed which can be related to diffusible substances from the pollen into the medium. This was not observed when calcium and magnesium were present in the medium. The phenomenon is explained as an enrichment of the medium with diffusible substances from non-germinated dead pollen. Germination and tube growth were found to be greatly dependent on a short period of equilibration of pollen at room temperature before sowing. (auth) (Sweden)

490 TISSUE LEVEL OF RADIOACTIVITY AFTER ADMINISTRATION OF THE SECOND DOSE OF TRITIATED CHLORMETAZANONE. Furlani, A.; Tomasi, A. P. (Univ., Trieste, Italy). Boll. Soc. Ital. Biol. Sper.; 45: 345-8(31 Mar 1969). (In Italian).

Chlormetazanone, chemical composition 2-(-chlorophenyl)-3-methyl-4-metathiazone-1,1-dioxide, is used as muscle relaxant, antispasmoticum, anticonvulsant, and as a general depressant. It is given orally or intravenously, though recently rectal administration has become ever more common. Tritiated chlormetazanone was synthesized according to the method of Wilzbach with a specific activity of 8.07 μc/mg. Since the substance is not soluble in water, solubility was attained by mixing it with equal amounts of dimethylsulfoxide. In this form it was used for oral and rectal administration to rats in doses of 202 μc resp. 25 mg per kg. This dose was applied to 30 male rats of 100g, which were divided into 5 groups of 6 animals. The 1st group received blanks. The 2nd and 3rd groups got an oral dose and were sacrificed 30 or 60 min respectively, after administration. The 4th and 5th groups received rectal administration and were also sacrificed after 30 or 60 minutes respectively. The blood of the decapitated animals was rapidly removed and heart, liver, spleen, kidneys, and bladder as well as muscle sections retained for investigation. The organs were cleaned and tissues examined for radioactivity using a liquid scintillation counter. The measurement results were presented in four graphs according to organ, time, and mode of administration. The data showed that in all cases the rectal administration resulted in higher radioactivity than the oral one. (F.J.W.)

491 DISAPPEARANCE OF ^{131}I-LABELED THYROXINE (^{131}I-T_4) FROM AGAR PELLETS IMPLANTED IN THE HYPO-

THALAMUS OF RATS. Averill, R. L. W. (Univ. of Tennessee, Memphis). Endocrinology; 87: 176-8(Jul 1970).

A measured number of cpm of radioiodine labeled thyroxine ($^{131}I-T_4$) in agar (2 or 4%) were implanted in the region of the paraventricular nuclei of the hypothalami of 33 rats. The rats were sacrificed 0.5, 2, 6, or 24 hr later and the number of cpm measured in the hypothalamus, the rest of the brain, liver, kidneys, thyroid, and plasma. Cpm in hypothalamus and brain fell steadily over the 24 hr. By 0.5 hr 52% of cpm remained in the hypothalamus, by 2 hr 31% remained, by 6 hr 15 to 20% remained, and by 24 hr <1% remained at the site of implantation. The % cpm originally implanted which was found in liver rose to 7% at 6 hr, at which time 1% of the implanted counts were present in each ml of plasma and 0.45% of the original cpm were present in the kidneys. Thyroidal accumulation of ^{131}I continued over the 24 hr studied and was affected by the diet of the rats. Loss of $^{131}I-T_4$ from the implant site by 6 hr was not affected by diet, by the concentration of agar (2 vs. 4%), or by the presence of carrier T_4. These results are discussed in relation to the probable site of action of T_4 in depression of thyroidal release of ^{131}I. (auth)

492 RADIOISOTOPES IN THE STUDY OF THE BLOOD-BRAIN BARRIER AND CEREBRAL EDEMA. Bakay, Louis (State Univ. of New York, Buffalo). Amer. Lect. Ser.; No. 771, 3-25(1970).

Data are reviewed from radioisotope tracer studies on the role of the blood-brain barrier in the exchange of various molecules between blood and normal and pathological brain tissue. The influence of the size of the cerebral extracellular space on the exchange of primarily extracellular tracers between blood and extracellular fluid is considered and it is pointed out that at present neither the size nor the chemical composition of the extracellular compartment of the brain is known. Results are reported from tracer studies in cats in which ^{24}Ha, ^{36}Cl, and ^{32}P and autoradiography were used in an attempt to determine the size of the extracellular space of normal or freshly wounded brains. The influence of cerebral edema on the distribution of ^{131}I-labeled serum albumin, ^{24}Ha, ^{42}K, $^{35}SO_2$, and ^{32}P in cat brain tissues was also studied using electron microscopy and autoradiography. The value of radioisotope scanning, using ^{131}I-labeled serum albumin, ^{197}Hg- or ^{203}Hg-labeled chlormerodrin, ^{99}Tc-labeled pertechnetate, or ^{68}Ca-labeled edathamil for the demonstration of vascular lesions in human patients is discussed briefly. (64 references) (C.H.)

493 STUDY OF THE QUANTITATIVE DISTRIBUTION OF RADIOACTIVE AND STABLE IODINE IN THYROID GLAND. Malenchenko, A. F. Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 1, 119-21(1970). (In Russian).

Autoradiographic studies of the distribution of radioactive and stable iodine in serial sections of the thyroid gland of intact rats were conducted. It was shown that the overall distribution of radioactive iodine was greater than that of stable iodine. (tr-auth)

Radiation Effects

Refer also to abstracts 142, 535, 543, 590, 612, and 613.

494 (AD-806412) TETRAZOLES AS INDICATORS OF RADIATION DAMAGE. Gierlach, Z. S.; Krebs, A. T. (Army Medical Research Lab., Fort Knox, Ky.). 3 Jan 1950. 21p. (USAMRL-33). NTIS.

Radiation effects on enzyme systems in living tissues were studied by the use of tetrazolium salts. Plant seeds irradiated with x rays and then treated with tetrazolium salts showed that the irradiation effect can be detected by changes in the reducing power of the enzyme systems and could be measured by the amount of colored formation formed. The relation between dose and radiation effect on the reducing systems can be written in exponential functions with a constant characteristic for the proper enzyme systems. The environment is of great importance. The radiation effect was altered when seeds were irradiated in the wet or dry states, different pH values, pre- or post-treatment with various chemicals, etc. (USGRDR)

495 (CONF-680529-, pp 453-65) HEMATOLOGIC AND BIOCHEMICAL ALTERATIONS IN ^{90}Sr-INDUCED HEMATOPOIETIC NEOPLASMS OF SWINE. Hackett, Patricia L.; Vogt, Glenda S.; Jannke, C. C.; Howard, E. B. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Leukopenia and thrombocytopenia were the major cellular responses in swine fed 125 μCi of ^{90}Sr per day. The median age for the appearance of myeloproliferative disorders in animals on this regimen was 70 months for adults and 34 months for their offspring. Variants of the dyscrasias observed at this dose level were myeloid metaplasia and myeloproliferative neoplasia of the granulocytic, eosinophilic, myelomonocytic, and erythrocytic types. Characteristic peripheral-blood values for each variant are presented. Significant cytochemical studies include peroxidase and alkaline phosphatase reactions. Analyses of serum components revealed changes in protein values attributed to an increased globulin fraction and in the activity of serum enzymes, such as serum glutamic oxaloacetic transaminase and the lactic acid dehydrogenase isoenzymes. None of the tests on peripheral blood were sufficiently specific to distinguish between myeloid metaplasia and aleukemic neoplasia. (auth)

496 PRODUCTION OF FREE RADICALS IN DNA AND INACTIVATION OF ITS BIOLOGICAL ACTIVITY BY γ RAYS. Hoff, A. J. (Univ. of Leiden); Koningsberger, D. C. Int., J. Radiat. Biol.; 17: 459-65(1970).

The biological significance of damage induced in DNA by ionizing radiation is quantitatively compared with free radical concentration as measured by E.S.R. spectroscopy. Biologically-active DNA of the bacteriophage ϕX174 dried together with carrier DNA was irradiated with γ-rays under vacuum. E.S.R. spectra were recorded at room temperature with a double-cavity spectrometer. After dissolution of the samples the biological activity of the ϕX174 DNA was measured. Absolute spin concentrations were measured with an accuracy of 25 percent. The G-values for biological inactivation and for production of free spins were 1.3 and 3.2 (±10 percent). Inactivation curves were exponential up to at least 5 Mrads; radical concentration, however, became saturated at about 2 Mrads. Cysteamine protected to the same extent against inactivation and free spins. (auth) (UK)

497 QUANTITATIVE RADIATION EFFECTS IN HEMOPROTEINS AND THEIR CONSTITUENTS. Crippa, P. R.; Vecli, A. (Univ., Parma, Italy). Biophys. J.; 10: 269-76(Mar 1970).

The radical yield of several hemoproteins irradiated with x rays at increasing doses was measured. In order to verify the radiation protection effect of prosthetic groups in irradiated conjugated proteins and the influence of their electronic structure on intramolecular excitation transfer, two series of substances were examined. The first was composed of ferrihemoglobin and its constituents and the second was composed of similar hemoproteins with heme groups with major differences in electronic structure. The results point to a strong radiation protection effect of the heme groups and a dependence of radical yield of hemoproteins on the electronic structure of the heme. A possible interpretation of this latter effect is discussed. (auth)

498 IN VITRO DEGRADATION OF DEOXYRIBONUCLEIC ACID BY CRUDE EXTRACTS FROM SALMONELLA TYPHIMURIUM AND ESCHERICHIA COLI B/r. Djordjevic, N.; Hudnik-Plevnik, T. A. (Boris Kidric Inst., Belgrade). Int. J. Radiat. Biol.; 17: 493-6(1970).

Salmonella typhimurium and Escherichia coli were studied for the activity of exonuclease which preferentially breaks down irradiated DNA. The measure of the activity was the difference between the rate of degradation of irradiated and unirradiated DNA treated with crude bacterial extracts. The degradation of ^{14}C labeled control and x irradiated DNA was measured at increasing concentrations of the DNA and results showed that at the maximum rate of DNA degradation, (42 μg/ml), the difference in the degradation of control and irradiated DNA was about 3 times greater with the extract of E. coli B/r than with the extract of S. typhimurium. (UK)

499 COMPARATIVE STUDY ON THE INFLUENCE OF FAST NEUTRONS (14 MeV) AND X-RAYS ON THE GLYCOGEN CONTENT IN MOUSE LIVER. Berndt, J.; Langendorff, M.; Kofler, E. (Univ., Freiburg i.B.). Int. J. Radiat. Biol.; 18: 193-6(1970).

The same LD75/30 days was used for both irradiations. For X-irradiation, mice were given a single whole-body irradiation with 690 R (150 kV, 20 mA, dose rate of 148 R/min). With fast neutrons, mice received a single whole-body irradiation of 530 rads (γ contamination was less than 10%). All animals were fasted 24 hrs prior to killing. Neutron and X-irradiation led to almost the same increase of glycogen in the mouse livers, but the peaks appeared at different intervals after exposure. After neutron irradiation, the highest glycogen content observed was 97μ moles/g 3 days after exposure; after x-irradiation, it was 117μ moles/g 14 days after exposure. (UK)

500 GUANIDINE NUCLEOTIDES IN BRAIN FOLLOWING NEUTRON IRRADIATION. Famichenka, K. V.; Gameza, M. V.; Surykau, P. M. Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 1, 85-90(1970). (In Ukrainian).

The content of guanidine nucleotides in the brain of rats was studied using controls and conditions of whole-body irradiation by intermediate neutrons in a dose of 13.5 rads. Using thin-layer

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chromatography and electrophoresis, the presence in brain of GMP, GDP, and GTP was shown. The monophosphate of guanidine predominated. Under the conditions of irradiation the quantity of GMP increased especially during the first 8 hr. The content of GDP and GTP decreased maximally during this period. Subsequently, however, their quantity was normalized. GTP was subjected to the greatest changes. The total content of guanidine nucleotides decreased under the conditions of irradiation as a result of the complete separation of the phosphate nucleotides of guanidine. (tr-auth)

501 CONTENT OF SIALIC ACID IN THE TISSUES OF INTACT AND ADRENALECTOMIZED RATS FOLLOWING THE ACTION OF SMALL DOSES OF IONIZING RADIATION. Malashevich, Ya. V. Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk: No. 1, 96-8(1970). (In Ukranian).

Using thiobarbituric acid, the content of sialic acid in the brain, liver, heart, and blood of adrenalectomized animals (Wistar rats) was determined after neutron and x irradiation. The nature of the stored neutral amine derivatives in adrenalectomized animals differs from that of the irradiated intact animals at the same doses (40 and 13.5 Rads). Substituted hormone therapy did not eliminate the increased sensitivity of rats with removed adrenals to the action of the radiation if the conclusion is based on changes in the level of sialic acid in the tissues. (tr-auth)

502 FORMATION AND EXCRETION OF TAURINE IN X-IRRADIATED RATS. Raghavan, K. G.; Nadkarni, G. B. (Bhabha Atomic Research Centre, Bombay). Int. J. Radiat. Biol.: 18: 41-9(1970).

Urinary excretion profiles of taurine were estimated in male Wistar rats exposed to doses of x-rays ranging from 100–1000 R. Maximum levels were observed in urine collected 24 hours after irradiation. Urinary taurine returned to normal values within 48 hours only in rats which had received sublethal doses (100–400 R). The high taurine levels persisted even after 72 hours in rats receiving more than LD_{50}, i.e., 600–1000 R. The dose-response relationship obtained indicates a sort of a threshold dose beyond which the recovery mechanisms apparently do not operate. Urinary excess of taurine could be ascribed to enhanced liver cysteic acid decarboxylase activity. The increase in enzyme activity corresponds to the maximum appearance of taurine in the urine. Cysteine sulfinic acid decarboxylase did not show any variation. Formation of taurine in vivo was also followed up after intraperitoneal injection of cysteine-3-^{14}C. There was enhanced recovery of radioactivity of the injected amino acid in blood and urine of x-irradiated animals, indicating increased synthesis of taurine. Hypertaurinuria could be prevented by prior treatment with desoxypyridoxine. (auth) (UK)

503 ULTRAVIOLET REACTIVATION IN BACTERIOPHAGE LAMBDA. Hart, M. G. R.; Ellison, J. (Queen's Univ., Belfast). J. Gen. Virol.; 8: 197-208(Sep 1970).

Reactivation of damaged phage λ_v by recombination with prophage (prophage reactivation) and by uv irradiation of host bacteria (uv reactivation) were similar in that uv- and nitrous acid-damaged phage was reactivated in both, both were eliminated by three rec alleles, neither was much affected by her alleles, and both were dependent on the degree of homology between phage and bacterial DNA. These results support a mechanism of uv reactivation by recombination between damaged phage DNA and host bacterial DNA. No evidence was obtained to support the hypothesis that uv reactivation acts by enhancing host cell reactivation. Prophage reactivation occurred only in bacteria lysogenic for a prophage genetically related to the superinfection phage λ_v and integrated at the gal/bio attachment site. Non-lethal periods of thymine starvation of the host bacteria caused reactivation of uv-irradiated phage λ_v, comparable with uv reactivation. (auth)

504 RADIATION SENSITIVITY STUDIES OF PLANT PIGMENTS. III. IN VITRO STABILITY OF β-CAROTENE IN AQUEOUS DISPERSIONS. Ramakrishnan, T. V.; Sawant, P. L.; Kumta, U. S. (Bhabha Atomic Research Centre, Trombay, India). Radiat. Bot.; 10: 395-9(Sep 1970).

β-carotene adsorbed on sugars, sucrose, glucose, or fructose (3–15%) forms stable dispersions in water. In these systems, β-carotene apparently forms a complex with sugars, since complete extraction in petroleum ether is possible only by addition of methanol (30 percent). The complex in water does not show spectral characteristics of β-carotene dissolved in petroleum ether. Evidence is presented indicating greater radiation stability of β-carotene in aqueous dispersions than that in lipid solvents. The enhanced stability is attributed to formation of β-carotene–sugar complex, since free sugar does not seem to have a protective influence on the pigment. (auth) (UK)

505 STUDY BY THE METHOD OF ELECTRON PARAMAGNETIC RESONANCE OF THE RADICAL REACTIONS OF PROPYL GALLATE IN IRRADIATED FROZEN SOLUTIONS OF DNA IN THE PRESENCE OF OXYGEN. Postmikova, M. S.; Ginzburg, S. F.; Uspenskaya, M. S.; Gaponova, I. S. Biophysics (USSR) (Engl. Transl.); 14: 977-80(1969).

The radioprotective properties of propyl gallate (PG) were studied using electron paramagnetic resonance methods to investigate the mechanism of the radical interactions between PG and calf thymus DNA γ irradiated with 3 Mrad. The OH radical was used as an internal standard and interaction was studied from –196° to –60° and for concentrations of PG from 2.5–20 mg/ml. (UK)

506 RADIATION EFFECT ON THE EXTRACTABLE SUBSTANCES OF POPLAR WOOD. Kreitsberg, Z. N.; Sergeeva, V. N.; Grabovskii, Ya. K. (Inst. of Wood Chemistry, Riga). Khim. Drev.; No. 2, 9-12(1968). (In Russian).

The quantity of extraction substances obtained from the woody tissue grown during July, August, and September in the scions irradiated with 5000 R of γ rays and 1000 rad of fast neutrons increased 1.5 to 2 times in comparison to the controls. The analysis of the substances extracted from the shoots revealed a 1.5 times increase of phenol hydroxides as compared with control samples. (R.V.J.)

507 HIT THEORY AND ITS SIGNIFICANCE IN THE INVESTIGATION OF EFFECTS OF LOW RADIATION DOSES. Fuchs, G. (Franz Josef Hospital, Vienna). Cesk. Radiol.; 23: No. 1-2, 28-32(Feb 1969). (In German).

A brief review is given on the problem of biological effects of low doses of radiation and the problem of existence of a threshold dose. The one-hit theory has been verified by a number of carefully prepared experiments, and it provides a correct explanation of radiation-induced mutations. Thus it seems to be established that no threshold dose exists. (NSA of Czech.)

508 AMIDE GROUPS OF PROTEINS OF THE BRAIN AFTER WHOLE-BODY IRRADIATION OF ANIMALS BY X RAYS. Pikulev, A. T.; Tal'kovskaya, L. C. (Belorussian State Univ., Minsk). Dokl. Akad. Nauk BSSR; 12: 1127-9(Dec 1968). (In Russian).

The dynamics of water-soluble amide groups and the general proteins of the brain of white rats following x irradiation to a dose of 40 and 100 R in 1, 3, 7, and 15 days were studied. The results of the investigations indicate that in general proteins, following irradiation at a dose of 40 R, there is an increase in the quantity of labile and a decrease in the quantity of firmly bound amide groups in all periods studied, as well as 15 days in the case of the difficult to hydrolyze fractions. Statistical treatment confirmed the validity of changes in the content of labile groups toward the end of 1, 7, and 15 days and firmly bound groups toward the 7th and 15th days. An increase in the amide groups of the general proteins was found mainly toward the end of the 15th day. In the water-soluble proteins, on the contrary, there was a decrease in the quantity of labile amide groups in all periods other than day one and there was an increase in the content of firmly bound amide groups. There was also an increase in the quantity of amide nitrogen in proteins, other than on day 15. Following a 100 R dose of x rays, it was found that the direction of changes of labile amide groups of the general proteins was the same, but more expressed, than in the 40 R series. In the firmly bound fractions, the content of amide nitrogen was not decreased but rather increased in all periods except day three. (tr-auth)

Ecology

Refer also to abstracts 2 and 521.

509 (IDO–12073, pp 37-42) ENVIRONMENTAL BRANCH. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

From annual report, 1969.

Routine radiation monitoring activities at the NRTS on-site and off-site locations during 1969 are reported. Filterable airborne radioactivity and external γ exposure rate were monitored continuously at all stations. Weekly composite samples of milk from the environs were analyzed for ^{131}I and ^{90}Sr. Ground water was monitored to determine the fate of radioactivity released via seepage ponds and disposal wells. A list is included of publications that report results from research and development projects. (C.H.)

510 PLANT UPTAKE OF ^{210}Po FROM SOIL. Hansen, W. R.; Watters, R. L. (Colorado State Univ., Fort Collins). Radiat. Bot.: 10: 371-5(Jul 1970).

A study of plants grown in $^{210}PoO_2$ contaminated soil indicated definite uptake through the root system. The Po concentration in the tissues varied with plant species and decreased with period of

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growth. Transfer coefficients (^{210}Po per g dry plant/^{210}Po per g dry soil) were calculated and ranged from 3×10^{-2} to 3×10^{-4} for the plants grown in $^{210}PoO_2$ contaminated soil. Comparison of the natural concentrations of ^{210}Po in plants with the data for those grown in contaminated soil confirmed that natural fallout of radon daughters is the primary source of natural ^{210}Po in plants. (auth) (UK)

511 RADIOCONTAMINATION OF THE ENVIRONMENT AND ITS EFFECTS ON THE MOTHER AND FETUS. III. PART II. RETENTION OF ^{137}Cs BY PREGNANT WOMEN, PLACENTAE, AND INFANTS. Nagai, T. (National Inst. of Radiological Science, Chiba, Japan); Iinuma, T. A.; Uchiyama, M.; Ishimara, T.; Yashiro, S.; Sternberg, J. Int. J. Appl. Radiat. Isotop.; 21: 363-74(Jun 1970).

Whole-body counters were used to measure the content of ^{137}Cs in pregnant women, placental tissues, and infants. Eleven pregnant women were measured monthly for six months ante partum and for nine months post-partum. Nine infants were measured periodically for ^{137}Cs between 35 and 262 days following birth. Placental tissues were placed in polyethylene bags and stored in a freezer until they were ashed and counted for ^{137}Cs content. Data on the ^{137}Cs content in relation to ^{40}K content in pregnant women, placental tissues, and infants are compared to the content in healthy males residing in the same geographical area. The total body content of ^{137}Cs did not reflect variations in the ^{40}K content observed in pregnant women during the last month before delivery. Comparison of the data with findings on men indicated that the rate of metabolism of both ^{137}Cs and ^{40}K is accelerated during pregnancy. (C.H.)

512 INTERCEPTION AND RETENTION OF A SIMULATED FALLOUT BY AGRICULTURAL PLANTS. Witherspoon, J. P.; Taylor, F. G. Jr. (Oak Ridge National Lab., Tenn.). Health Phys.; 19: 493-9(Oct 1970).

Five species of agricultural plants (clover, peanuts, sorghum, soybeans, and squash) were contaminated in the field with two particle size ranges of a quartz fallout simulant containing ^{86}Rb. Initial fallout interception and retention of particles up to eight weeks was determined. Loss of fallout from foliage caused by the weathering action of wind and rain (weathering half-lives) and loss caused by weathering plus radiological decay (effective half-lives) were determined for all species. The initial interception of smaller particles (44 to 88 μ dia.) by foliage was 2.5 times that of larger particles (88 to 175 μ dia.). Particle interception was correlated with leaf area and varied between species by a factor of 65 in terms of μCi ^{86}Rb/g foliage. After rapid initial losses of fallout (67% lost the first week after deposition), differences in retention rates between species became non-significant. Retention times of the two particle size ranges were also found to be similar. (auth) (UK)

Genetics and Cytogenetics

Refer also to abstracts 507, 606, and 608.

513 DIFFERENT MODES OF LOSS OF PHOTOREVERSIBILITY OF ULTRAVIOLET LIGHT-INDUCED TRUE AND SUPPRESSOR MUTATIONS TO TRYPTOPHAN INDEPENDENCE IN AN AUXOTROPHIC STRAIN OF ESCHERICHIA COLI. Nishioka, H.; Doudney, C. O. (Albert Einstein Medical Center, Philadelphia). Mutat. Res.; 9: 349-58(Apr 1970).

The loss of photoreversibility of uv induced mutations to tryptophan independence in a tryptophan requiring strain of Escherichia coli (left after "mutation frequency decline," produced by incubation in the absence of the amino acid, has eliminated most suppressor mutations) occurs during the first 20 min of postirradiation incubation. It is amino acid independent but is blocked by dinitrophenol. It is independent of DNA replication since it occurs in the presence of nalidixic acid, an inhibitor of DNA replication. Loss of photoreversibility of the suppressor mutations (subject to mutation frequency decline) occurs in correlation with the initial doubling of DNA in the culture and may be prevented by nalidixic acid, suggesting that DNA replication is required for such loss. The initial postirradiation replication of DNA is significant to the mutation process since expression of both sorts of mutation (measured on tryptophan free minimal agar medium) does not occur unless DNA synthesis is allowed before plating and is prevented by nalidixic acid. The data are consistent with the hypothesis that dimer excision accounts for loss of photoreversibility of stable reversions to tryptophan independence but that DNA replication is necessary to this process for suppressor mutations of this requirement subject to mutation frequency decline. (auth)

514 GENETIC EFFECTS OF ^{131}I IN MICE. Reddi, O. S. (Osmania Univ., Hyderabad, India). Nature (London); 227: 961-2(29 Aug 1970).

Male mice aged 10 to 12 weeks were given an intraperitoneal injection of ^{131}I in the form of NaI in doses of 0.2, 0.5 and 0.7 μCi, and 24 hrs after injection mated with untreated females of the same age. The mated females were dissected on the 15th day of gestation and the number of live and dead embryos were recorded. Control observations were made on females mated to untreated males. It was found that the ^{131}I had a demonstrable effect on the intrauterine deaths, and the observations clearly indicated mutagenic effects of ^{131}I in mice. The effects during the different periods of mating (1 to 4 weeks) are shown graphically; the peak period for all doses seemed to be the second and third weeks, and the sperm screened during these periods would probably have been in the spermatid stage at the time of injection. The high sensitivity of spermatids was also shown by other workers using x-rays and ^{90}Sr. The significantly high incidence of intrauterine deaths during the first and fourth weeks suggests that ^{131}I could also cause chromosomal breaks in spermatozoa and spermatocytes. It is concluded that the results of the investigation point to possible hazards of any indiscriminate use of radioiodine in human medicine. The mechanism of the mutagenic action needs further exploration. (UK)

515 GENETIC DEFECTS AND RADIATION DAMAGE: THE INHIBITION OF MITOTIC ACTIVITY, ITS MUTATION-INDEPENDANT CAUSES AND THEIR SIGNIFICANCE IN PROBLEMS OF CELL PROLIFERATION RADIATION RESISTANCE AND RADIATION STIMULATION. von Wangenheim, K.-H. (Kernforschungsanlage, Juelich, Ger.). Radiat. Bot.; 10: 469-90(Sep 1970). (In German).

The inhibition of mitotic activity occurring in the diploid and autotetraploid forms of two species (Oenothera hookeri and Hordeum vulgare) immediately after x irradiation is shown to be subject neither to induced specific genetic defects (mutations) nor to irreversible nuclear inactivation. It is, however, due to premature differentiation caused by an unequal duration of transitory inhibited development of nucleus and cytoplasm. After x-irradiation of metabolically mitotically active tissue the major part of the total damage is attributable to premature differentiation and inhibition of mitotic activity rather than to purely genetic effects. (auth) (UK)

516 GENETIC-EVOLUTIONARY STUDIES ON CULTIVATED CANNAS. IV. PARALLELISM BETWEEN NATURAL AND INDUCED SOMATIC MUTATIONS. Mukherjee, Iva; Khoshoo, T. N. (National Botanic Gardens, Lucknow, India). Radiat. Bot.; 10: 351-64(Jul 1970).

High level heterozygosity, sterility, and the rather long duration between sexual generations, all restrict improvement of canna through hybridization and selection. Thus natural and induced somatic mutations may offer an easier method for producing new variation. The more common flower color changes are spots and stripes, which are generally unstable. However, one whole-color change in 3x Rosamund Coles treated with 1 kR proved to be stable. Color mutations in canna usually involve a change from red to yellow. This course also underlies the origin of yellow colored Queen of Italy from the pure red King Humbert in nature. The former cultivar is very unstable and its flower color ranges from pure yellow, yellow with red spots, streaks, and sectors, to pure red. The number, length, and breadth of the red spots, stripes, and sectors show the number of mutations, and the stage in ontogeny at which they occur. Such an interconversion of King Humbert and Queen of Italy through somatic mutations may be the result of instability of the relevant color gene(s). This example, together with similarity in leaf variegations and flower abnormalities between natural and induced mutants investigated here, shows a parallelism between the two, and also the role somatic mutations can play in the origin of new cultivars. Interchanges and reduction of pairing in diploids and autotriploids in the treated plants are the result of rearrangements caused by radiation, but such detectable changes do not account for all their sterility. There is also no strict correlation between the extent and nature of induced phenotypic and chromosomal changes. Using lethality or severe growth inhibition as an index, the triploids are more radiation-resistant than diploids. This may be due to either the buffering effect of the presence of duplicate loci or a reduced interphase chromosome volume in triploids. (auth) (UK)

517 EFFECT OF TEMPERATURE ON X-RAY INDUCED CELL LETHALITY AND CHROMOSOMAL ABERRATIONS. Dewey, W. C.; Miller, H. H. (Colorado State Univ., Fort Collins). Int. J. Radiat. Biol.; 18: 91-3(1970).

Male Chinese hamster lung cells of the Don strain, with 80% of the cells in the late S phase, were x irradiated with 49 keV at a

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dose rate of 300 rads/min. Changes in the response were investigated when cells were irradiated at 37°C or 22°C, and then either returned immediately to the incubator at 37°C, or left at room temperature for 40 to 60 minutes. Cells irradiated and maintained at 37°C had most damage, and cells irradiated at 22°C and kept at 16°C for 40 mins had least damage, the chromosome aberration frequency decreasing by a factor of 1.6 and the survival fraction increasing by a factor of 1.9. Radiosensitivity was intermediate for cells irradiated at 37°C and transferred to 16°C for 50 min, and for those irradiated at 22°C and then transferred to 27°C. 95% of the exchanges were of the chromatid type and the ratio of exchanges to deletions was 0.24 to 0.33 with no apparent dependence on temperature conditions. (UK)

Health Physics and Safety

Refer also to abstracts 209 and 210.

518 (IDO–12073) ANNUAL REPORT, 1969. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.). Jul 1970. 51p. Dep. CFSTI.

Eight papers on the 1969 activities of the Health Services Laboratory of the Idaho Operations Office (AEC) are presented. Separate abstracts were prepared for 7. One was not in the scope of NSA. (L.C.L.)

For abstracts of individual papers see: 40, 260, 277, 368, 509, 522, and 534.

Radioactive Contamination and Decontamination

Refer also to abstracts 208 and 511.

519 (RLO–2225-T-10-1) AQUATIC MYXOBACTERIA; CHONDROCOCCUS COLUMNARIS. Progress Report, 1970. Ordal, Erling J. (Washington Univ., Seattle. Dept. of Microbiology). Contract AT(45-1)-2225. 30p. Dep. CFSTI.

Studies were carried out on 24 out of 29 strains of Chondrococcus columnaris isolated from sockeye salmon or directly from water in McKinley Creek and the Horsefly River in the Fraser River Basin. Although around 50% of the adult sockeye salmon in the run died before spawning, it was not possible to ascribe the loss except in part to columnaris disease; unlike the situation in 1965, the parent run when the 47% mortalities were all ascribed to columnaris disease. Water temperatures in the main Horsefly River remained low, well below 55°F, while in 1965 water temperatures reached levels as high as 65°F. In 1969 McKinley Creek reached a level of 67°F before the siphon and dam, constructed at a cost of $300,000, were turned on and the water temperature was reduced to 50°F before fish were permitted to enter the creek. The mortalities were obviously due to gill disease. While these may have been due in part to C. columnaris, other bacteria were consistently found on other fish showing gill damage. These include large myxobacteria and small gram negative rods, as yet unidentified, frequently found in clusters on gill tissues. Eighteen out of twenty-four strains of C. columnaris from the 1969 isolates were tested for virulence and exhibited high virulence. This indicated that high virulence strains of C. columnaris, isolated both from fish and water, were present in the Horsefly River basin and could have led to catastrophic losses of adult sockeye salmon due to columnaris disease if water temperatures had reached high levels. Five cultures of C. columnaris obtained from Dr. Shigo Egusa of Japan exhibited unusual serological types and included the two major different types of C. columnaris isolated in the United States, Canada, and Europe. Additional studies were carried out on cultures of myxobacteria isolated from Atlantic salmon suffering from ulcerative dermal necrosis in Ireland. In the absence of field data it is only possible to conclude that myxobacterial pathogens are involved in the disease. One experiment indicated that myxobacteria from Irish salmon killed young Pacific salmon at a low water temperature, i.e., 55°F. A virus disease of sockeye salmon occurring at 55°F can be controlled or cured by raising the water temperature to 68°F for a period of 10 days. Unfortunately a stock of experimental sockeye salmon held at Leavenworth, Washington, for our experimental use was destroyed because of concern about this disease. With the impending and necessary construction of nuclear power plants using sea water for cooling, it has become important to investigate the role of water temperature on diseases due to marine vibrios. An active program is now under way on the nature of the marine vibrios and the effect of water temperature on disease in fish due to these organisms. (auth)

Dosimetry and Monitoring

Refer also to abstracts 258, 367, 372, 377, 382, 444, 509, 564, 575, and 912.

520 (AD–708428) EXTERNAL BEAM MEASUREMENTS ON THE TEXAS A. AND M. VARIABLE ENERGY CYCLOTRON. Final Report, March 1968–May 1969. Burton, Ben S.; Parker, C. Varren Jr.; Boles, Larry A. (Nuclear-Chicago Corp., Austin, Tex. Texas Nuclear Div.). May 1970. Contract F41609-68-C-0029. 18p. (SAM-TR-70-25). NTIS.

The external proton beam of the Texas A. and M. University Variable Energy Cyclotron (TAM-VEC) was studied to determine its suitability for special large-animal irradiations. Broad, uniform beams were produced by multiple-coulomb scattering of the narrow primary beam. Various energies were produced by placing absorbers in the beam or by varying the cyclotron energy, or by using both techniques. Beam uniformity, energy, energy-spread, dose rate, and, in some instances, depth-dose profiles were measured in the exposure plane for a number of energies. The USAF School of Aerospace Medicine personnel measured depth-dose distributions with thermoluminescent dosimeters embedded in plastic phantoms. (auth) (USGRDR)

521 (BNWL–1341(App.)) EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD FOR 1968. APPENDICES. Wilson, C. B. (ed.) (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). May 1970. Contract AT(45-1)-1830. 136p. Dep. CFSTI.

Data from radiation monitoring studies in the vicinity of Hanford, Washington, during 1968 are tabulated. Data are included on the content of ^{137}Cs, ^{131}I, ^{32}P, ^{89}Sr, ^{90}Sr, and ^{65}Zn in samples of human food including farm produce, milk, Columbia River fish, and water fowl; the radioisotope content in samples of Columbia River water, drinking water supplies, and the atmosphere; the content of radioisotopes in oysters from Willapa Bay, and the content of ^{131}I in thyroid glands from beef cattle slaughtered in Washington and Oregon during the period. (C.H.)

522 (IDO–12073, pp 12-17) DOSIMETRY BRANCH. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

From annual report, 1969.

The major objectives of the Dosimetry Branch are to supply personnel radiation dosimetry service to the NRTS; to maintain complete records of exposure doses; to provide consulting and support service to contractors regarding dosimetry problems; and to perform research aimed at improving monitoring devices and systems. In 1969 services were provided for 25 contractors at 21 separate geographical locations at the NRTS. More than 7,000 persons were monitored during the year which involved the processing of approximately 54,254 permanently assigned beta–gamma dosimeters. The Branch also provided special processing of 1,896 permanently assigned dosimeters at the request of the contractors' health physicists, and processed some 65,552 other nonroutine items. In addition nearly 26,000 temporary dosimeters for transient personnel were processed during the year, and personnel monitoring coverage was provided for approximately 200 personnel of three off-site governmental agencies involving some 600 TLD badges. A total of 119,806 dosimeters of various types were processed during the year. The exposure data show that 6,792 persons, or 87.5%, accumulated less than 500 mrem (the level at which monitoring is required); 863 persons or 11.2% accumulated between 0.5 and 3.0 rem (the AEC radiation protection guide for a calendar quarter); and 103 persons, or 1.3%, accumulated between 3.0 and 5.0 rem. No one exceeded 5.0 rem (the radiation protection guide per year for occupational exposures). The total accumulated whole-body exposure for the entire NRTS for 1969 was 1,723 rem for an average of 259 mrem per person covered by the program, compared to the current ten-year average of 314 mrem per year. Results of 7,053 urinalyses and 1,641 in vivo determinations during 1969 were entered into the personnel radiation exposure records. No significant exposures were found. (auth)

523 SPECTRAL-ANGULAR DISTRIBUTIONS OF ELECTRONS IN WATER. Lyubomirov, A. M.; Pozdneev, D. B. (Gorky State Univ., USSR). Med. Radiol.; 15: No. 7, 63-9(Jul 1970). (In Russian).

Various characteristics of electrons penetrating through water slabs were calculated by the Monte Carlo method. There are differential and integral energy spectra and penetration coefficients. The normal incidence of electrons with energies between 50 KeV and 10 MeV is discussed. (auth)

524 USE OF STERLING'S METHOD FOR THE CALCULATION OF ISODOSE CURVES. Kozlov, A. P.; Afanas'ev, B. P.;

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Yustinov, S. A. (Scientific-Research Inst. of Oncology, Moscow). Med. Radiol.; 15: No. 7, 70-4(Jul 1970). (In Russian).

Values of empirical coefficients in the formula of dose calculation for source-surface distances of 50, 60 and 75 cm are derived. It is shown that the use of an analytical expression allows calculation of dose distributions in the irradiated medium in radium therapy on Rokus gamma-emitter. (auth)

525 COMPARISON OF DOSE DISTRIBUTION BY THE METHOD OF RECIPROCAL DEDUCTION. Denisenko, O. N.; Il'ichev, B. V.; Kozlov, V. A. (Obninsk Inst. of Medical Radiology, USSR). Med. Radiol.; 15: No. 7, 74-6(Jul 1970). (In Russian).

A method of quantitative comparison of two isodose pictures with the aid of their reciprocal deduction is proposed as the result of which one obtains the distribution of differences of relatively deep doses. The essence of the method is demonstrated by an example of comparison of two dose fields from Rokus gamma-emitter, obtained in different source—skin distances. (auth)

526 TECHNIQUE OF DOSIMETRY ON THE LAYER LEVEL OF HALF WEAKENING OF THE ABSORBED DOSE IN SHORT-DISTANCE ROENTGENOTHERAPY. Ruderman, A. I.; Vainberg, M. Sh.; Narkevich, B. Ya.; Korf, N. N. (Inst. of Experimental and Clinical Oncology, Moscow). Med. Radiol.; 15: No. 7, 52-5(Jul 1970). (In Russian).

A method is described for determining the spatial distribution of absorbed doses in tissue-equivalent phantom in short-distance irradiation on RUM-7 roentgen apparatus. A technique is proposed that allows the determination of the radiation doses for patients in short-distance roentgenotherapy on the level of the layer of half weakening of the absorbed dose. (auth)

527 RADIATION DOSES IN THE USE OF RADIOISOTOPE METHODS IN THE STUDY OF THE LIVER FUNCTION. Mirkhodzhaev, A. Kh. (Inst. of Experimental Endocrinology and Chemistry of Hormones, Moscow). Med. Radiol.; 15: No. 7, 38-43(Jul 1970). (In Russian).

The values of radiation loadings on the whole body, liver, spleen and gonads calculated on the basis of quantitative parameters of kinetics of exchange of some organotropic compounds are presented. The maximal permissible dose for labeled rose bengal comprises about 150 μC, radioactive colloidal gold 6 μC, labeled particles of human serum albumin 170 μC. For the conduction of liver tests the use of the compounds in quantities not more than 20 μC is recommended. Scanning of the liver with radioactive colloidal gold in patients with liver cirrhosis should be conducted only in accordance with strict clinical indications. (auth)

528 UTILIZATION OF ULTRASOUND IN THE PLANNING OF RADIOTHERAPY. Weyrauch, Ulf; Schoknecht, Guenter (Auguste-Viktoria-Krankenhauses, Berlin). Strahlentherapie; 139: 544-7(May 1970). (In German).

Ultrasound examination with the B-scan method is useful for obtaining cross section for external beam telecobalt radiotherapy planning. This method is particularly useful for treatment planning of bladder tumors because of the variations caused by the difference between a full and an empty organ. (auth)

529 COMPUTATION OF DEPTH DOSE DISTRIBUTION FOR ANY RECTANGULAR FIELDS BASED ON DEPTH DOSE TABLES FOR CENTRAL BEAM OF CIRCULAR OR SQUARE FIELDS. Popp, Fritz A. (Univ., Marburg, Ger.). Strahlentherapie; 139: 532-7(May 1970). (In German).

Description is made of a method permitting the calculation of depth dose spreading in rectangular fields of any side proportions A relation introduced by Pfalzner is used for this purpose and enlarged into fields of differently sized surface areas. Compared to Clarkson's method, this procedure offers the advantage of less calculation time and, at the same time, the saving of storage requirements. (auth)

530 REPLY TO COMMENT ON "EFFECTIVE TRANSMISSION OF THE HUMAN THORAX FOR PHOTONS FROM ^{239}Pu, ^{241}Am, AND OTHER LOW-ENERGY EMITTERS." Bukovitz, A. G.; Brodsky, A. (Univ. of Pittsburgh). Health Phys.; 19: 585(Oct 1970).

In reply to Dean et al (Health Phys. 19:312, 1970), further details of the phantom used in the original work are given and calculations and another experiment are discussed all of which give credence to the original results obtained of the attenuation of 17 keV x rays. (UK)

531 DOSIMETRY OF THE PROTON BEAM. Astrakhan, B. V.; Boreiko, V. F.; Bugarchev, B. B.; (and others) (Inst. of Experimental and Clinical Oncology, Moscow). Med. Radiol.; 15: No. 7, 55-62(Jul 1970). (In Russian).

Dosimetric, adjustment and auxiliary equipment necessary for irradiation of oncological patients and biological objects on a medical proton beam of the Laboratory of Nuclear Problems is described. For different conditions of irradiation dose measurements were conducted on homogeneous tissue-equivalent phantoms. (auth)

Radiation Protection

Refer also to abstracts 574 and 1913.

Safety Procedures

Refer also to abstract 1670.

532 EYES AND COSMIC RAYS. Finch, B. E. Brit. Med. J.; 3: 405(15 Aug 1970).

Astronauts in Apollo 13 reported seeing repeated flashes of light, even with closed eyes, and this effect was attributed to the impact of cosmic rays on the retinal cells. It was found that some healthy people experience similar light flashes associated with vitreous floaters (the vitreous colloidal gel possibly acting as a bubble chamber with high energy particles passing through it). It is suggested that work is necessary on the possible increase in these symptoms with the arrival of sun spot activity and the subsequent increase in cosmic rays at ground level. (UK)

533 MEDICAL SURVEILLANCE FOLLOWING RADIATION OVER-EXPOSURE. Hill, S. M. B. Trans. Soc. Occup. Med.; 20: 28-30(Jan 1970).

The medical surveillance following an incident at A.E.R.E. when two reactor operators received radiation doses above that permitted is described. The doses received were similar to what might be expected in accidental exposure to a γ radiographic source or in an accident where a radiographer entered a room in which an industrial x-ray set was still operating. (auth)

Civil Defense

Refer also to abstract 353.

Medicine

Refer also to abstract 518.

534 (IDO-12073, pp 18-24) MEDICAL BRANCH. (Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.).

From annual report, 1969.

The Medical Branch at the NRTS provides an occupational medical service that includes physical examinations (pre-placement, periodic, termination, and special); diagnosis and treatment of occupational illnesses and injuries; emergency or short-term treatment of nonoccupational illnesses and injuries; and consultation with contractors and employees on health problems. Complete medical records are kept of all patient visits at the NRTS dispensaries. Nearly 5,000 examinations for internal radioactivity have been made on NRTS personnel in the medical van since it was first placed in operation in 1966. Significant personnel time is saved by performing these procedures in each plant area with a mobile unit. Blood and urine samples and chest x rays are procured during the same visit as part of the periodic medical examination program. Additional procedures such as blood chemistry profiles, PAP tests, and pulmonary function testing were added to the periodic physical examination in 1969. (auth)

Protective Substances

Refer also to abstracts 496, 505, 590, and 602.

535 CHANGES OF RADIORESISTANCE IN MICE FOLLOWING A SEVERAL DAY EXPOSURE TO HYPOXIA: ENZYME ACTIVITY OF TRYPTOPHANE AND METABOLISM OF CYSTEINE. Streffer, Christian; Tribukait, Bernhard; Schafferus, Sigrid (Univ., Freiburg i. B. Karolinska Inst., Stockholm). Strahlentherapie; 139: 626-33(May 1970). (In German).

Following exposure to hypoxic conditions, radioresistance of mice was investigated. In the liver and at the time of particular radiosensitivity the activity of various enzymes was measured: kynureninase, kynurenine-aminotransferase, cysteineoxygenase, and decarboxylase of the aromatic amino-acids. A decrease of kynureninase and decarboxylase was observed when radioresistance also decreased. An increase, however, was noted of cysteine-oxygenase when the survival of the mice was greater than in con-

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trols. The possible implications of this enzymatic variation for the radiosensitivity of the animals were discussed. (auth)

536 ENHANCEMENT OF X-RAY DAMAGE IN HeLa CELLS BY EXPOSURE TO LUCANTHONE (MIRACIL D) FOLLOWING RADIATION. Bases, Robert (Albert Einstein Coll. of Medicine, New York). Cancer Res.; 30: 2007-11(Jul 1970).

The colony-forming ability of HeLa cells that survived an initial dose of x irradiation proved abnormally sensitive to lucanthone. Surviving cells gradually regained normal resistance to lucanthone treatment, which implied with lucanthone was acting to inhibit a postradiation repair process. Enhancement of cell killing by lucanthone was comparable in degree to that induced by actinomycin D, with which it shares many properties. Lucanthone merits further study as a possible adjunct in clinical radiation therapy, since it is a relatively safe drug which has been widely used for many years in the treatment of human schistosomiasis. (auth)

537 EFFECT OF PROPHYLATIC ADMINISTRATION OF AET (AMINO-ETHYL-ISOTHIOURONIUM-BROMIDE-HYDROBROMIDE) ON HEMATOLOGICAL CHANGES IN IRRADIATED RATS. Arient, M.; Pospisil, J.; Dienstbier, Z.; Vetrovcova, E. (Charles Univ., Prague). Strahlentherapie; 139: 619-25(May 1970).

During the study of protective effectiveness of AET in irradiated rats the examination of bone marrow was carried out in 232 rats. Immediately after the application of AET at a dose of 150 mg/kg b.w. an irritation and an increase in the cell counts of all bone marrow components, except of lymphocytes, occurred without morphological anomalies. In spite of a slight variation of the counts of individual cell types this stimulating effect of a single AET dose on the marrow hematopoiesis lasted more than four weeks. In animals irradiated with a single dose of 600 R x rays, the i.p. application of AET did not influence the initial suppression of hematopoiesis but favorably affected the regeneration that appeared earlier than in non-protected animals and had a stable character. Morphological changes of cells were similar in protected and non-protected irradiated rats. The staining for the proof of iron, glycogen, and non-specific esterase activity was effective as a suitable cytochemical reaction. (auth)

Radiodiagnosis

Refer also to abstracts 378, 397–399, 487, 492, and 1736.

538 ERRORS IN ROENTGEN-RADIOLOGICAL INVESTIGATIONS OF DYNAMIC OBJECTS. Gorbushin, N. G. (Inst. of Medical Radiology, Moscow). Med. Radiol.; 15: No. 7, 77-9 (Jul 1970). (In Russian).

A method of absorption and scattering of radiation for studying dynamic systems and organs is discussed. A method for assessment of errors of the process from conditions of adequate statistics of the count is proposed. (auth)

539 CONTACT RADIOMETRY IN THE DIAGNOSIS OF MALIGNANT NEOPLASMS OF THE LUNGS. Krishtafovich, A. A.; Butorin, E. P.; Tsarev, A. S. (Leningrad Research Inst. of Tuberculosis). Med. Radiol.; 15: No. 7, 19-23(Jul 1970). (In Russian).

Contact radiometry was performed with controlled beta-probes in 25 patients with different diseases of the lungs. In 13 patients with a diagnosis of lung cancer the relative accumulation of ^{32}P in the affected bronchus varied from 127 to 226%, averaging 160 ± 7.19%. In another group of nine patients with nonmalignant diseases, tuberculosis, pneumonia, cysts, the relative ^{32}P accumulation varied from 81 to 117%, averaging 98.0 ± 3.75%. The lower border of relative ^{32}P accumulation in the lungs in malignant tumors is considered to be 125%. Methodically performed contact radiometry may be used clinically in pulmonary diseases for the differential diagnosis of malignant and benign diseases of the lungs. (auth)

540 DIMINISHED OXIDATION OF ^{14}C-UL-L-ASPARAGINE TO $^{14}CO_2$ IN MICE AND HUMANS WITH TUMORS: A POSSIBLE MEANS FOR ASSESSING EFFICACY OF THERAPY. Chaudhuri, Tuhin K.; Winchell, H. S. (Univ. of California, Berkeley). Contract W-7405-Eng-48. J. Nucl. Med.; 11: 597-601(Oct 1970).

Excretion of $^{14}CO_2$ in the breath was measured after i.v. administration of ^{14}C-UL-L-asparagine to control mice, to mice with transplanted anaplastic carcinoma, and to two humans with plasmoblastic mycloma and lymphoblastic leukemia, respectively. Excretion was measured before and after specific therapy. Tumor-bearing mice excreted approximately 40% less $^{14}CO_2$ than control animals. On the other hand, excretion of $^{14}CO_2$ after administration of ^{14}C-UL-L-aspartic acid was identical in normal and tumor-bearing mice. After partial extirpation of the tumor, the $^{14}CO_2$ excretion rate following administration of ^{14}C-UL-L-asparagine increased toward normal values. Concentration of ^{14}C from labeled asparagine in the mouse tumor was generally greater than in muscle but less than that in liver, spleen, and kidney. The two patients showed increased $^{14}CO_2$ excretion following ^{14}C-asparagine administration after therapy compared with before therapy. Measurements of $^{14}CO_2$ similar to those described may be useful in assessing efficacy of therapy of tumors. Studies with ^{14}C substrates other than L-asparagine may prove useful in delineating systemic metabolic abnormalities associated with various neoplastic processes. (auth)

541 DETECTION OF CARDIAC TUMOR BY RECTILINEAR IMAGING WITH ^{131}Cs. Quaife, Merton A.; Wilson, William J. (Univ. of Nebraska, Omaha). J. Nucl. Med.; 11: 605-7(Oct 1970).

Primary neoplasms of the heart are rare, with the majority of these growths being benign in nature. However, clinical course does not bespeak a benign entity since death usually results from functional impairment at this critical anatomic site. Currently available cardiovascular surgical techniques require consideration of additional means of detecting the presence of this disease early in its course. The delineation of a myocardial tumor, pathologically identified as a fibroma by ^{131}Cs myocardial scanning, is reported. This finding is correlated with data from a heart pool scan, selective coronary arteriography, and angiography as well as more commonly available adjunct procedures. Operation confirmed the presence of tumor at the anatomic location correlating with the scan. The lesion was successfully removed, and the patient has made an uneventful recovery. The use of myocardial scanning with the radionuclide ^{131}Cs is suggested as a valuable adjunct in the differential diagnosis of myocardial lesions in cases suspected of having primary neoplasms of the heart. (auth)

542 ISOTOPE CISTERNOGRAPHY IN THE EVALUATION OF PATIENTS WITH SUBARACHNOID HEMORRHAGE. Williams, J. P.; Pribram, H. F. W.; Lynde, R. H.; Sharpe, A. R. (Medical Coll. of Virginia, Richmond. Virginia Commonwealth Univ., Richmond. Univ. of California, Irvine). J. Nucl. Med.; 11: 592-6 (Oct 1970).

Isotope cisternography using high specific activity IHSA was performed on 21 patients following subarachnoid hemorrhage from various sources. Ten of these were found to have communicating hydrocephalus. There was a higher incidence of communicating hydrocephalus in patients with aneurysms about the Circle of Willis than in those with middle cerebral or posterior cerebral artery aneurysms. (auth)

543 TISSUE NAD LEVELS AND RESPONSE TO IRRADIATION OR CYTOTOXIC DRUGS. Calcutt, G.; Ting, S. M.; Preece, A. W. (Mount Vernon Hospital, Middlesex, Eng. Bristol General Hospital, Eng.). Brit. J. Cancer; 24: 380-8(Jun 1970).

It has been shown that when ^{32}P counting from a tumor is continuous, peaks in the count rate can sometimes be induced by large doses of nicotinic acid, nicotinamide, or 3-acetylpyridine, but not by 6-aminonicotinamide. These ^{32}P counting peaks have been associated with the time of maximal new synthesis of nicotinamide adenine dinucleotide (NAD). Sensitization to irradiation or some cytotoxic drugs has been found at the peak of the new NAD synthesis. The radioprotective agents cysteamine, 2-aminoethylisothiouronium bromide (AET) and serotonin have been found to cause a rapid fall in tissue NAD levels. The results have been briefly discussed. (auth) (UK)

544 FUNCTIONAL STATE OF THE LIVER IN PATIENTS WITH CANCER OF THE LUNGS, STOMACH, AND OVARIES ACCORDING TO DATA OF RADIOISOTOPE HEPATOGRAPHY. Starinskii, V. V. Med. Radiol.; 15: No. 7, 23-30(Jul 1970). (In Russian).

Radioisotope hepatography with radioiodine-labeled rose bengal was employed for determining the liver function in 108 patients suffering from cancer of the lungs, stomach, and ovaries. The functional state of the liver was studied depending on the localization of the malignant process, its spread and diseases sustained in the past. There was found a definite influence of the localization of the neoplastic process on the absorptive-excretory function of the liver. The above test revealed changes of the absorptive-excretory function of the liver in a large number of cases in comparison with other techniques. (auth)

545 DIAGNOSTIC RESULTS OF NUCLEAR MEDICINE IN POLYCYSTIC DEGENERATION OF KIDNEYS. Hennig, K.; Vetterlein, K.; Woller, P.; Kirsch, E. (Carl Gustav Carus Medizinische Akademie, Dresden). Deut. Gesundheitsw.; 24: 2137-43(6 Nov 1969). (In German).

Results of renoscintigraphy and isotope nephrography in 21 patients suffering from polycystic renal degenerations were re-

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ported. Renoscintigraphically, parenchymous disfunctions were recorded. From stage II onward they reached a severe degree, in two cases unilaterally only of medium severity. In all stages organ enlargements were observed. Except for two cases, they occurred bilaterally. By way of isotope nephrography in all stages functional disturbances were detected. In stage I the light disturbances were prevailing. From stage II onward the findings were invariably of a more severe type. In cases of polycystic renal degeneration the nuclear medical diagnostic methods essentially contributed to complete the adequate diagnosis. They offer the advantage of involving no risks and but a low ray-exposure. Besides they can be repeated according to necessity at any time. (auth)

546 ONE CASE HISTORY OF POSTTRAUMATIC INTRAHEPATIC BILE CYST WITH SECONDARY RUPTURE. Schriber, K.; Wirth, W.; Kaestner, F.; Akovbiantz, A. (Chirugische Univ., Zurich). Schweiz. Med. Wochensch.; 100: 1321-4(25 Jul 1970). (In German).

Report on a case of posttraumatic intrahepatic bile cyst which ruptured initially into the right subphrenic space and subsequently into the peritoneal cavity is given. Radiodiagnostic methods using ^{198}Au in liver trauma and its late complications are demonstrated, and some aspects of bile peritonitis are discussed. The treatment of intrahepatic bile cyst consists of surgical repair of the liver, drainage of the cyst and temporary decompression of the bile ducts. (auth)

547 RADIONUCLIDE APPLICATIONS IN NEUROLOGY AND NEUROSURGERY. Wang, Yen; Paoletti, Pietro (eds.). American Lecture Series, No. 771. Springfield, Ill., Charles C Thomas, Publisher (1970). 375p. $27.50.

Separate abstracts were prepared for each of the 13 chapters in this publication. (E.R.B.)

For abstracts of individual chapters see: 492, 548–555, and 569–572.

548 RADIOISOTOPIC METHODS FOR CEREBRAL BLOOD FLOW DETERMINATION. Oldendorf, William H. (Wadsworth Veterans Administration Hospital, Los Angeles). Amer. Lect. Ser.; No. 771, 27-53(1970).

The relative merits of various radioisotopes, methods of administration, and radiation detectors commonly used for measurements of cerebral blood flow are compared. The radioisotopes include ^{79}Kr, ^{85}Kr, and ^{133}Xe, which are administered by inhalation techniques, and ^{131}I-labeled-4-iodoantipyrine, ^{125}I- and ^{131}I-labeled human serum albumin, ^{131}I-labeled hippurate, metastable ^{99}Tc-labeled pertechnetate, and ^{32}P-labeled erythrocytes, which are administered by injection. Radiation detectors include scintillation scanners and γ cameras. It was concluded that radioisotopes provide valuable information, but do not give an absolute index of brain blood flow. (76 references.) (C.H.)

549 CEREBRAL BLOOD FLOW IN NEUROLOGICAL AND NEUROSURGICAL PATIENTS. Fieschi, Cesare (Univ., Rome). Amer. Lect. Ser.; No. 771, 55-75(1970).

The diagnostic value of radioisotope tracer studies of regional cerebral blood circulation in patients with neurological disorders, cerebrovascular diseases, and following brain surgery is discussed. Techniques evaluated include the use of ^{85}Kr injected into the intracarotid artery followed by removal of a blood sample from the jugular vein for measurement of blood-brain transit time, and scintillation scanning following the injection of ^{85}Kr, ^{79}Kr, ^{131}I-labeled antipyrine, or the inhalation of ^{133}Xe, for measurements of blood circulation. It was concluded that the techniques used at present have limited diagnostic value. (104 references.) (C.H.)

550 COUNTING TECHNIQUE IN GAMMA ENCEPHALOGRAPHY. Planiol, Therese (Univ. Orleans, Tours, France). Amer. Lect. Ser.; No. 771, 77-102(1970).

The technique of scintillation counting in contact with the skull at a number of points combined with serial counts of frontal and lateral aspects of the skull for radioisotope scanning of the brain is described. The effectiveness of this counting technique and suitable data analysis for the diagnosis of neoplasms in the brain following the administration of ^{197}Hg- or ^{203}Hg-labeled chlormerodrin, ^{131}I-labeled human serum albumin, or metastable ^{99}Tc-labeled pertechnetate is illustrated by the description of diagnostic results in 10 patients. (45 references.) (C.H.)

551 BRAIN SCANNING WITH POSITRON EMITTERS. Aronow, Saul (Massachusetts General Hospital, Boston). Amer. Lect. Ser.; No. 771, 103-22(1970).

The principles of brain scanning using positron-emitting radioisotopes are discussed. It is pointed out that the positron itself is not useful for external detection. The positron interacts with a negative electron in the annihilation process that produces two γ rays that proceed in exactly opposite directions. This allows the technique of coincidence detection to be utilized for spatial localization by means of a pair of scintillation crystals placed on opposite sides of the source of the annihilation radiation. These physical properties allow the design of instrumentation that has high sensitivity with good resolution and quite uniform response over a circumscribed symmetrical organ such as the brain. Positron-emitting isotopes that have been used for brain scanning include ^{47}V, ^{68}Ga, ^{18}F, ^{64}Cu, ^{72}As, ^{89}Zr, ^{124}I, and ^{74}As, which is used most frequently. The design features and electronic components of positron scanners and positron cameras are described and illustrated photographically. Results of $^{74}As_2O_4$ positron scans in 1278 patients with a clinical diagnosis of brain tumor and in 2618 patients with a clinical diagnosis of non-neoplastic brain disease are summarized. (17 references.) (C.H.)

552 BRAIN SCANNING WITH GAMMA EMITTERS. Wang, Yen (Univ. of Pittsburgh). Amer. Lect. Ser.; No. 771, 123-61(1970).

Brain scanning has been found to provide a simple, accurate screening test for the early diagnosis of disorders of the nervous system that cannot be established with certainty by clinical findings alone. Focal lesions that cause an alteration of neurological function can be demonstrated by scanning without the need for hospitalization and without discomfort or danger to the patient. Brain scanning is also of value in detecting and evaluating various neoplastic, inflammatory, vascular, traumatic, and congenital space-occupying and non-space-occupying brain lesions, that may or may not be associated with neurological disorders. The most widely used application of brain scanning is in the diagnosis and localization of brain tumors, the majority of which are slow growing and locally expansive. Early diagnosis improves the possibility that such lesions can be removed surgically and result in a cure with neurological function preserved. The accuracy of brain scanning for the localization of various types of neoplasms in adults and children and for the diagnosis of other brain lesions is discussed. A list of γ-emitting radioisotope-labeled compounds used as tracers for brain scanning is included and the merits of each and of various scanning instruments are discussed. Typical scans made using ^{99m}Tc or ^{203}Hg are illustrated and discussed. (299 references.) (C.H.)

553 RADIOISOTOPE CISTERNOGRAPHY AND VENTRICULOGRAPHY. Ashburn, William L. (Univ. of California, San Diego); Dichiro, Giovanni. Amer. Lect. Ser.; No. 771, 163-90(1970).

Radioisotope cisternography and ventriculography are special procedures in nuclear medicine for the study of cerebrospinal fluid flow of value for the diagnosis and evaluation of a wide variety of neuropathological conditions. A number of radioisotopes have been injected intrathecally for diagnostic purposes but so far only the labeled albumin products have been found suitable for cisternography. The most commonly used are ^{131}I-human serum albumin (RIHSA) and ^{99m}Tc-human serum albumin. Technetium-99-labeled pertechnetate is also used for ventriculography. Injection techniques and radiation counting equipment used are described and the risks and complications associated with the technique are discussed. Results obtained using the technique for the diagnosis of a variety of physiological, infectious, traumatic, and neoplastic conditions in the brain are reported. (74 references.) (C.H.)

554 SCANNING OF THE SPINAL SUBARACHNOID SPACE AFTER INTRATHECAL INJECTION OF ^{131}I-LABELED HUMAN SERUM ALBUMIN. Huebner, Karl F.; Brown, Donald W. Amer. Lect. Ser.; No. 771, 191-7(1970).

A technique for myeloscintigraphy following the intrathecal injection of ^{131}I-human serum albumin is described. Results obtained in 16 patients are reported. It is concluded that the procedure is safe and is a useful screening method for the localization of intraspinal lesions. (17 references.) (C.H.)

555 RADIOACTIVE ISOTOPES IN THE STUDY OF THE HYDROCEPHALIC DISEASE. Migliore, A.; Paoletti, P.; Villani, R. (Univ., Milan). Amer. Lect. Ser.; No. 771, 327-60 (1970).

Application of radioisotopes (^{82}Br, ^{36}Cl, ^{38}Cl, ^{42}K, ^{24}Na, ^{32}P, and tritium) as tracers to study cerebrospinal fluid production, absorption, and circulation in experimental animals and man is reported, with emphasis on diagnostic studies in patients with hydrocephalus. The diagnostic value of ^{131}I-serum albumin, ^{99m}Tc-albumin, and ^{99m}Tc-pertechnetate brain scanning in patients with hydrocephalus is discussed. (116 references.) (C.H.)

556 SIMPLE INSTRUMENT FOR SIMULTANEOUS SUBTRACTION OF SCANNING IMAGES. Steven, L. W. (Royal Melbourne Hospital, Parkville, Australia). Australas. Bull. Med. Phys. Biophys.; No. 45: 9-12(1 Aug 1970).

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Subtraction of the liver image from the ^{75}Se selenomethionine pancreas scan is achieved using a difference amplifier constructed from an integrated circuit operational amplifier that quantitatively removes the ^{198}Au liver image from the ^{75}Se pancreas image detected by the respective amplifier analyzers. (Australia)

557 RADIOLOGICAL, PHYSIOLOGICAL, AND ANATOMICAL STUDIES ON THE EFFECT OF A NEW CONTRAST MEDIUM FOR UROGRAPHY. Schulten, H.-J.; Lennartz, H.; Maurer, H.-J.; Huth, F. (Univ., Duesseldorf). Fortschr. Geb. Roentgenstr. Nuklearmed.; 112: 818-25(Jun 1970). (In German).

A triiodated contrast medium containing lithium instead of sodium was tested in cats. Administration of more than 5 ml of the medium produced cardiac insufficiency and renal damage. These toxic effects probably resulted from excess lithium. (H.B.G.)

558 COMPARISON OF ^{99m}Tc PERTECHNETATE AND ^{113m}In EDTA WITH RESPECT TO BRAIN SCINTIGRAPHY. Kuba, J.; Husak, V.; Sevcik, M.; Klaus, E. (Palacky Univ., Olomouc, Czech.). Fortschr. Geb. Roentgenstr. Nuklearmed.; 112: 806-13(Jun 1970). (In German).

For brain scintigraphy, calculation of physical properties as well as experimental findings showed that ^{99m}Tc is superior to ^{113m}In. Compared were clinical findings on 33 patients in whom brain scintigraphy was performed after administration of ^{99m}Tc pertechnetate and ^{113m}In EDTA. Generally, diagnostic accuracy did not differ significantly between the two isotopes; however, in a few cases, ^{113m}In yielded more detailed pictures of brain lesions. (tr-auth)

559 FUNCTION OF LYMPH NODE BARRIER IN MAN INVESTIGATIONS WITH ^{51}Cr-LABELED ERYTHROCYTES. Peters, P. E. (Univ., Zurich). Fortschr. Geb. Roentgenstr. Nuklearmed.; 113: 83-8(Jul 1970). (In German).

In order to study the lymph node barrier in man, ^{51}Cr-marked erthrocytes were injected intralymphatically in 19 patients. Only those cases were evaluated in whom passage of marked cells into the peripheral blood was observed after they had traveled through the entire lymphatic chain. Repeated blood samples taken before, during and after the injection and measurements in a scintillation counter permitted calculation of the percentage of cells retained in the lymphatic system. A significant reduction in barrier function was found after irradiation of large volumes and after endolymphatic therapy with ^{131}I-lipiodol. Diagnostic lymphography with oily contrast media did not lead to an increased escape of marked cells from the lymph nodes. (F.St.)

560 PROBLEMS IN SCINTIGRAPHIC DETECTION OF ABDOMINAL TUMORS WITH ^{75}Se-LABELED SELENITE. Iwig, J.; Schmalbach, J.; Thiemann, Kl. J. (Johanniter-Krankenhaus, Kreuzacker, Ger.). Fortschr. Geb. Roentgenstr. Nuklearmed.; 113: 89-96(Jul 1970). (In German).

Following intravenous injection of ^{75}Se-selenite, scanning of the abdominal cavity shows physiological increase of this substance in liver, kidneys, and sometimes in the colon. Malignant tumors of the pancreas, liver, gall bladder and ovaries may show accumulation of ^{75}Se-selenite; in an hemangioma of the liver, acute pancreatitis, a pancreatic cyst, and in an inflammatory mass in the pancreas with fibrosis selenite concentration could not be demonstrated. The ^{75}Se-selenite scan appears to provide a method for differentiating benign from malignant processes in cases where the ^{198}Au-liver scan and the ^{75}Se-methionine pancreas scan demonstrated a defect. (F. St.)

561 INVESTIGATIONS ABOUT THROMBOPLASTIC ACTIVITY: FIBRINOLYSIS AND PRECIPITATION BY ^{131}I FIBRINOGEN IN EXPERIMENTAL TUMORS. Hilgard, P.; Heyes, H.; Sigmund, E.; Hiemeyer, V. (Univ., Ulm, Ger.). Fortschr. Geb. Roentgenstr. Nuklearmed.; 113: 96-100(Jul 1970). (In German).

The thromboplastic activity of various experimental tumors was determined. After injection of heterologous radioiodinated fibrinogen a good representation only of the Yoshida sarcoma and Ehrlich carcinoma in the dot scan was found. With a scintillation counter it was demonstrated that all experimental tumors accumulate radioactivity. No significant increase of fibrinogen uptake by epsilon-amino-caproic-acid was found. The interrelation of the thromboplastic activity and the uptake of fibrinogen by the tumors were discussed. (auth)

562 RADIOLOGIC DETERMINATION OF MINERAL CONTENT IN BONE. FIRST REPORT. CORRECT APPLICATION OF RADIOLOGICAL MINERAL ANALYSIS WITH DIFFERENT BEAM QUALITIES. Gebhardt, M.; Zwicker, H. (Univ., Bonn.). Fortschr. Geb. Roentgenstr. Nuklearmed.; 112: 798-805(Jun 1970). (In German).

Mineral content of bone, expressed as hydroxyl-apatite-equivalent, was determined by x ray films obtained at two different energies. Instead of the linear equation proposed by Krokowski a more complicated formula was derived. This formula yielded results that, within measuring accuracy, were in good agreement with the actual hydroxyl-apatite-equivalent values. (H.B.G.)

563 CALIBRATION OF A WHOLE-BODY COUNTER WITH ^{226}Ra UNDER SPECIAL CONSIDERATION OF ABSORPTION AND SCATTERING OF γ RADIATION AS WELL AS THE DISTRIBUTION PATTERN IN MAN. Poulheim, K.-F. (Staatliche Zentrale fuer Strahlenschutz, Berlin). Strahlentherapie; 139: 553-64 (May 1970). (In German).

A calibration method for a whole-body-counter with ^{226}Ra, taking into account the absorption and the scattering by bodies of various dimensions, is described. A mathematical relation is presented, allowing to measure by calibration, from an in-vivo spectrum, and taking into account the absorption by various parts of the body and comparing it to a spectrum taken without absorbing medium. The application of this relation reduces the calibration problem to the measurement of the spectrum of a point source of radium without absorbing medium. The various calibration methods of whole-body-counter for radium are reviewed. The most accurate calibration is then performed with an anthropomorphous phantom in the chair which differs from the standard model. The method is described in detail. (auth)

Radiotherapy

Refer also to abstracts 524, 526–528, 531, 579, 596, 598–601, 642, 1684, and 1685.

564 RADIATION INJURY TO THE BRACHIAL PLEXUS IN PATIENTS WITH MAMMARY CARCINOMA. Notter, G.; Hallberg, O.; Vikterloef, K. J. (Regionskrankenhauses, Oerebro, Sweden). Strahlentherapie; 139: 538-43(May 1970). (In German).

After radiotherapy of 237 patients with operable or inoperable breast cancer, plexus brachialis lesions were noted in 41 cases, or 17%. In twelve of these cases, complete or partial motor paralysis of the forearm and the hand was observed. This complication can be ascribed to cross-fire effect of an anterior and lateral axillary field, or to a too high daily dose with short fractionation times. The calculated doses for these patients lay between 4500 rd/27 days and 8100 rd/21 days. When the doses are plotted on a double-logarithmic graph, the radiobiologic equivalent doses are obtained for nerve lesions. In order to prevent such lesions, individual planning is stressed. (auth)

565 ROTATION RADIATION OF ESOPHAGEAL CARCINOMA. Werner, H.; Lucks, R. (Univ., Kiel). Strahlentherapie; 139: 517-26(May 1970). (In German).

For the period from 1958 until 1966, 155 patients suffering from an esophageal carcinoma were discussed. Therapy was carried out by rotation irradiation under conventional deep-therapy conditions. 87% of the cases were esophagoscopically controlled, and 76% were histologically secured. 93% could be treated without interruption despite the high average age of 68.7 years. Survivors out of the latter were: 1 year: 36%; 2 years: 20%; 3 years: 9%; 4 years: 9%; 5 years: 9%; 6 years: 8%. Rotation irradiation of esophageal carcinoma under conventional conditions deserves an adequate rank beside telecobalt therapy or ultrahard irradiation. (auth)

566 RADIATION THERAPY OF SYRINGOMYELIA. Hallen, O.; Trappmann, H. (Univ., Heidelberg). Strahlentherapie; 139: 527-31(May 1970). (In German).

A follow-up of 30 cases of syringomyelia, of which 20 were treated with deep x-irradiation and 10 with general supportive measures, showed that radiotherapy constitutes a useful and relatively effective treatment in the absence of other efficacious therapeutic alternatives. Irradiation by no means leads to cure. With the correct and adequate dosage, however, it can at the least alleviate the pain; often, however, it stops the pain for years. Moreover, in a high percentage (at least 40%), it arrests the syringomyelitis process for years (for 20 years in one case). An actual improvement in the neurological findings could be observed in only 2 cases. In both of them the pathological process was located in the cervical spinal cord and the spastic signs in the legs receded slightly so that a decompression of the pyramidal tract due to radiologically induced edema flow can be presumed. No other favorable change in the neurological findings was noted. The failures were partially explained as follows: in one case the wrong region was irradiated; in 3 cases the dosage was too low;

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in one case only a single field was irradiated. Therefore, it can be concluded that radiotherapy in syringomyelia becomes significant only if the disease region is really covered, if at least 2 fields are irradiated, and if the surface dosage/field amounts to at least 1500 R (single dose = 300 R). Irradiation damage did not appear at all. (auth)

567 FUNDAMENTAL PHYSICAL CONSIDERATIONS AND PRACTICAL ASPECTS OF THERAPY WITH HIGH-ENERGY ELECTRONS. Vogel, K.-H. (Univ., Tuebingen, Ger.). Roentgenpraxis; 23: 164-72(Jul 1970). (In German).

Therapy with high-energy electrons is reviewed from the physical and clinical standpoint. Analyzed are electron energy, field size, collimation, and focus-skin distance. (H.B.G.)

568 INTRAARTICULAR THERAPY OF PROGRESSIVE CHRONIC POLYARTHRITIS WITH COLLOIDAL ^{198}Au. Zielke, A.; Correns, H. J.; Unverricht, A.; Stiller, K.-J. (Friedrich-Schiller-Univ., Jena, Ger.). Deut. Gesundheitsw.; 25: 1013-20 (3 Jun 1970). (In German).

In 110 patients, mainly suffering from progressive chronic polyarthritis, 130 intraarticular injections of colloidal radioactive gold were performed. In preliminary medical examinations applying subtherapeutic activities it was detected that the radiation exposure of other endangered organs (liver and regional lymph nodes) was very low. Sixty patients received therapeutic amounts ranging from 2.5 to 5 mCi radiogold colloid, corresponding to a knee-joint dose of about 2000 rad per mCi of activity applied. After an observation period ranging from 6 months to 2 years well over two thirds of all patients manifested a significant mitigation of pain, an improved mobility function, as well as a decreased formation of exudate; this refers, above all, to PCP-patients in the first stages of the disease. Moreover, almost one third of the PCP-patients also manifested a mitigation of pain in the joints not treated with radio-gold. Corresponding to literary data, the therapeutic results achieved roughly corresponded to that of surgical synovectomy. The only side-effect observed after altogether 130 intraarticular injections of radio-gold was in nine cases a temporary irritative effusion on the joint treated. In autoradiographic animal experiments it was detected one hour following the intraarticular injection the radioactive gold colloid could be traced in the marginal cellular layers of the synovial membrane. (auth)

569 TREATMENT OF BRAIN TUMORS WITH INTERSTITIALLY APPLIED RADIOACTIVE ISOTOPES. Mundinger, F. (Univ., Freiburg i. B.). Amer. Lect. Ser.; No. 771, 199-265(1970).

The use of permanent implantations of solid radioisotopes or the instillation of radioactive solutions for the treatment of malignant brain tumors is discussed. Various methods of interstitial irradiation and the properties of various radioisotopes used, including ^{32}P, ^{198}Au, ^{90}Y, ^{60}Co, ^{182}Ta, and ^{192}Ir are discussed. Criteria for the choice of solid and liquid radiation sources are included. Results are reviewed for a number of cases. A number of patients were able to lead a useful and productive life following surgical resection of neoplasms combined with interstitial radioisotope irradiation. (170 references.) (C.H.)

570 STEREOTAXIC IMPLANTATION OF RADIOACTIVE ISOTOPES IN FUNCTIONAL PITUITARY SURGERY: TECHNIQUE AND RESULTS. Talairach, J.; Bonis, A.; Szikla, G.; Schaub, G.; Bancaud, J.; Covello, L.; Bordas-Ferrer, M. (Hopitaux Psychiatriques, Seine, France). Amer. Lect. Ser.; No. 771, 267-99(1970).

The use of radioisotope implantation for pituitary ablation for the treatment of hormone-related physiological diseases and neoplasms is discussed. Surgical techniques used for pituitary implantation are described in detail. The radiation sources used included ^{90}Y, ^{198}Au seeds, and ^{192}Ir. Clinical results are reported for patients with acromegaly, Cushing's syndrome, diabetic retinopathy, hyperpituitarism, malignant exophthalmus, and metastases from breast cancer treated by radioinduced pituitary ablation using radioisotope implants. (73 references.) (C.H.)

571 CHEMICAL ASPECTS OF NEUTRON CAPTURE THERAPY. Soloway, A. H. (Northwestern Univ., Boston). Contract AT(30-1)-3267. Amer. Lect. Ser.; No. 771, 301-12 (1970).

The chemical aspects of neutron capture therapy are discussed with emphasis on the preparation of compounds incorporating ^{10}B with desirable physiological properties and binding properties for neoplastic cells. The ^{10}B(n,α)^{7}Li reaction emits 2.79 MeV energy. The theoretical advantage of the technique is the ability to destroy tumor tissues while producing little injury to surrounding tissues. The chemical structure of a number of boron compounds tested for use in neutron capture therapy is discussed. Of these compounds, the sulfhydryl compounds have the most attractive tumor-binding properties and preliminary studies in mice, rabbits, and monkeys are encouraging. It is concluded that the concept of neutron capture therapy for the treatment of brain tumors is attractive and clinical trials may soon prove encouraging. (47 references.) (C.H.)

572 HEAVY PARTICLES IN NEUROLOGY AND NEUROSURGERY: A REVIEW. Lawrence, John H. (Univ. of California, Berkeley); Tobias, Cornelius A.; Linfoot, John A.; Fink, Robert A. Amer. Lect. Ser.; No. 771, 313-26(1970).

Data are summarized from investigations carried out during a 30-year period on the uses of heavy charged particles in medicine. Successful clinical results are reported for the use of α beams and proton beams for pituitary gland ablation in the treatment of metastatic breast carcinomas, acromegaly, Cushing's disease, diabetic retinopathy, for thalamotomy in the treatment of Parkinson's disease, and for the direct treatment of brain tumors and other soft tissue tumors. It is concluded that cyclotron-produced high-energy charged particles (protons, α beams, pi meson beams) have important potentialities for use in therapy. (58 references.) (C.H.)

573 PROGRESS OF RADIOBIOLOGIC KNOWLEDGE AND RADIOTHERAPY OF CANCER. Tubiana, M. (Institut Gustave Roussy, Villejuif, France). Ann. Radiol.; 13: 506-22(1970). (In French).

The aim of radiotherapy is to destroy a tumor without causing excessive damage to surrounding tissues. This differential effect on normal tissues is obtained mainly through the use of the time factor either by using an intermittent dose or by using low dose rate irradiation. In spite of a great increase in our radiobiologic knowledge, the ways in which dose fractionation improves the therapeutic results are not yet fully understood. Its effect seems at least partly related to differences occurring between normal and malignant tissue in the rate of restoration and cell population kinetics. In order to study dose fractionation on a scientific basis and to determine the numerical value of the parameters involved a large amount of clinical investigation and experimental research remains to be done. (France)

574 PREVENTION OF RADIATION DAMAGE TO THE SMALL BOWEL BY USE OF A MAGNETIC DEVICE. Izsak, F. C. (Donolo Government Hospital, Yaffo, Israel); Brenner, H. J.; Tugendreich, J.; Yerushalmi, S.; Frei, Ephraim H. IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 350-1(Jun 1970).

From 2nd European Conference on Hard Magnetic Materials, Milan, Italy. See CONF-690964.

The possibility of using a magnetic device together with ingested Fe pellets, or other ferromagnetic material, for the translocation of loops of the small intestine to prevent radiation injuries during external beam radiotherapy of neoplasms of the cervix, ovary, or urinary bladder is discussed. Results of a test in one patient given Fe pellets orally showed that the intestine moved under the influence of the magnet. (C.H.)

575 CLINICAL STUDY OF THE BIOLOGICAL ACTIVITY OF TUMORS WITH THE AID OF ^{32}P. Agranat, V. Z. (Moscow Scientific-Research Inst. of Oncology). Med. Radiol.; 15: No. 7, 13-19(Jul 1970). (In Russian).

Clinical studies were performed on the dependence of the value of ^{32}P incorporation into tumors of the parotid gland, blastoma of soft tissues, and the rate of their growth. During the examination of patients with cancer of the uterine cervix, endometrium and skin, the relation between the level of ^{32}P incorporation into the tumor and value of the absorbed dose was determined. (auth)

Blast and Thermal Effects

576 (CONF-680529–, pp 501-16) MYELOPROLIFERATIVE DISORDERS IN ATOMIC BOMB SURVIVORS. Anderson, Robert E. (New Mexico Univ., Albuquerque); Yamamoto, Tsutomu (Atomic Bomb Casualty Commission, Hiroshima, Nagasaki (Japan)).

One of the delayed effects of exposure to significant amounts of ionizing radiation is the development of hematopoietic malignancies; consideration of these malignancies among atomic bomb survivors reveals an excess of cases that fall into the group of so-called myeloproliferative disorders. Of these, chronic myelogenous leukemia is markedly increased among the proximally exposed survivors (<1500 m from the hypocenter) and especially among those persons who were less than 30 years of age at the time of exposure [Bizzozero et al., New Eng. J. Med., 274: 1095 (1966)]. In the same group of individuals, acute myelogenous leukemia is also increased

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in prevalence in comparison with (1) distally exposed persons (1500 to 10,000 m); (2) a carefully selected population of persons who were in neither city at the time of the bomb; and (3) the incidence of leukemia in the remainder of Japan. Similar comparisons suggest that the prevalence of myelofibrosis with myeloid metaplasia is also increased in proximally exposed survivors [Anderson et al., Ann. Intern. Med., 60: 1(1964)]. The magnitude of increase of this uncommon disease approaches that observed with respect to myelogenous leukemia. At the present time, an increased prevalence of polycythemia rubra vera, primary thrombocythemia, and erythroleukemia has not been demonstrated in the surviving population; suggested explanations for this negative association will be discussed. Among the various myeloproliferative disorders, a comparison of exposed and nonexposed persons shows no morphologic differences attributable to radiation between individual cases in the corresponding diagnostic categories; however, similar comparisons suggest possible collective differences in survival time and organ weight between exposed and nonexposed cases of myelogenous leukemia. (auth)

Radiation Effects on Animals

577 EFFECT OF CONTINUOUS INTRACELLULAR RADIATION THROUGH ^{3}H-THYMIDINE ON PREGNANT RATS AND ON DEVELOPMENT OF THEIR OFFSPRING. **Haas, R. J.; Bohne, F.; Fliedner, T. M. (Univ., Ulm, Ger.). Strahlentherapie; 139: 571-86(May 1970). (In German).**

The effect of a continuous infusion of various doses of tritiated thymidine to rats from day 9 pregnancy until term was studied in mothers and their offspring. Doses of 288 μCi/day did not produce any damage to the animals. Higher doses (576 to 1440 μCi/day) resulted in an increasing radiation injury to the pregnant rats and their offspring: The mothers developed within 7 to 10 days after the beginning of the $^{3}H-TdR$ infusion a severe bone marrow aplasia shown by a decrease of all blood cell counts. At the highest dose the animals died after 10 to 12 days. In the newborn animals the whole development especially that of the hematopoietic system was impaired. At high doses the animals showed malformations. The damage of the hematopoietic system in pregnant rats as well as in their offspring is discussed in connection with the effects of $^{3}H-TdR$ to the stem cell pool. (auth)

578 CHANGES IN MITOTIC ACTIVITY AND LENGTH OF VARIOUS MITOTIC PHASES IN BONE MARROW CELLS TREATED EITHER WITH X RADIATION AND CHLOROQUINE. **Zak, Miroslav (Karls-Univ., Prague). Strahlentherapie; 139: 587-93 (May 1970). (In German).**

Changes of mitotic activity and shares of the single mitotic phases of bone marrow cells in mice by whole-body x-irradiation and by application of chloroquine, the latter being used as radiation protection, were investigated. Mitotic activity was expressed by the mitotic index, and the course of mitosis was recorded by means of karyokinetic curves. Mitotic activity was influenced favorably by chloroquine application, as was the course of mitosis of bone marrow cells during the radiation syndrome. Possibilities are certified to employ chloroquine in the treatment of several reactions of irradiation procedures. (auth)

579 EFFECT OF PROTONS (180 MeV) AT DIFFERENT AREAS OF BRAGG'S CURVE ON NORMAL AND NEOPLASTIC CELLS. **Shmakova, N. L.; Yarmonenko, S. P. (Moscow Inst. of Experimental and Clinical Oncology). Med. Radiol.; 15: No. 7, 8-12(Jul 1970). (In Russian).**

The dependence between RBE protons (180 MeV) and their LET (0.7–2.3 KeV) in respect to chromosomal aberrations and development of pyknoses in cells of bone marrow and tumors was studied. The maximal value of RBE obtained in Bragg's peak by the criterion of the number of cells with aberrations comprised ~1.3. The advantage of the studied beam of protons over x-rays and γ-rays, from the viewpoint of their use in radiation therapy of malignant tumors, consisted in the weak scattering and relatively localized run of particles in the tissues, this enabling to have a greater dose at the required depth. (auth)

Vertebrates

Refer also to abstracts 495, 499–502, 508, 514, 517, 519, 537, and 543.

580 (AD-708431) EFFECTS OF RADIATION ON CANINE LOCOMOTION. Final Report, November 1968–November 1969. **Watters, John W. (School of Aerospace Medicine, Brooks AFB, Tex.). Jun 1970. 7p. (SAM-TR-70-32). NTIS.**

Sixteen dogs were used to determine the effect of ionizing radiation on canine locomotion. The animals were run on a treadmill, at speeds of 3 to 5 mph, for periods of 60 to 75 min., with intermittent rest periods. Microswitches were attached to each dog's feet to determine the downtime for each foot. The radiation exposures ranged from 380 to 5005 rads of neutron-gamma ratios of 1:20 for ten dogs and 9:1 for the other six animals. The most common symptom after radiation exposure was vomiting. However, the emesis did not appear to be dose dependent. Although changes in the support formula could be demonstrated after irradiation, no statistical significance could be applied because of the limited number of subjects involved and because of the great variation in exposure levels and in neutron-gamma ratios. (auth) (USGRDR)

581 (CONF-680529) MYELOPROLIFERATIVE DISORDERS OF ANIMALS AND MAN. Proceedings of the Eighth Annual Hanford Biology Symposium at Richland, Washington, May 20–23, 1968. **Clarke, W. J.; Howard, E. B.; Hackett, P. L. (eds.) (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jun 1970. 765p. Dep. NTIS.**

Separate abstracts were prepared for ten of the papers. In addition, there were six papers in the session on normal myelopoiesis, four in the session on etiological factors associated with myeloproliferative disorders, 12 in the three sessions on pathology of myelogenous diseases, five in the session on immunology and biochemistry of myeloproliferative disorders, and five in the session on technological advances in the investigation of myeloproliferative disorders. Each session's discussion is presented and summary remarks are given. A list of participants and a subject index are provided. (C.O.)

For abstracts of individual papers see: 495, 576, 582–588, and 596.

582 (CONF-680529–, pp 71-83) MARROW HEMATOPOIFSIS IN PITMAN–MOORE SWINE FOLLOWING ^{90}Sr INGESTION. **Cooper, P. H. (Veterans Administration Hospital, Houston, Tex.); Clarke, W. J. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).**

Generation cycle times of swine hematopoietic cells were determined by analyzing tritiated-thymidine-labeled mitotic figure curves of marrow preparations from control swine and those chronically ingesting 625 μCi ^{90}Sr per day for $5\frac{1}{2}$ months. The subnormal blood neutrophil and normal red blood cell concentrations noted in the ^{90}Sr-fed animals could not be attributed to differences in cell production rates. Since production rates of both erythrocyte and myelocyte precursors were subnormal, extramedullary erythropoiesis was suggested as a possible source of red blood cells in these animals. The relation of continued subnormal mature neutrophil numbers to leukemia is discussed. (auth)

583 (CONF-680529–, pp 149-70) COMPARATIVE OBSERVATIONS ON RADIATION-INDUCED MYELOPROLIFERATIVE DISORDERS IN ANIMALS AND MAN. **Upton, Arthur C. (Oak Ridge National Lab., Tenn.).**

Ionizing radiation has been implicated as an etiologic agent in a wide variety of myeloproliferative disorders in animals and man. The particular lesion induced by irradiation varies, depending on the influence of physiological variables (such as species, strain, age, sex, metabolic state, and cell population kinetics in blood-forming organs) and radiological variables [dose, time-intensity factors, distribution of dose in tissue, linear energy transfer (LET)]. High-intensity irradiation of the whole body or a large fraction of the hemopoietic system causes depletion of hemopoietic cells, which may result in leukopenia, aplastic anemia, and pancytopenia. These effects, which are attributable primarily to killing of blood-cell precursors, may or may not be accompanied by regenerative hyperplasia of surviving hemopoietic cells or by other manifestations of repair, depending on the circumstances. With reduction of the dose, dose rate, and fraction of the hemopoietic system exposed, the depletion of hemopoietic cells decreases in severity and tends to be offset by compensatory regenerative hyperplasia. Hence, under these conditions, the predominant lesion is a myeloproliferative reaction. The proliferative lesion is, however, highly variable in cytologic character, organ distribution, time of onset, and course, depending on the variables mentioned above, ranging from a self-limited regenerative hyperplasia on the one hand to malignancy on the other. The relation of the various lesions to one another, their implications concerning reparable and irreparable types of radiation injury, the role of host factors, radiologic variables, and environmental agents (such as leukemia viruses and cocarcinogenic chemicals) in the pathogenesis of the lesions, and the comparative aspects of the lesions induced by radiation, as opposed to those arising through other mechanisms, are discussed. (auth)

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584 (CONF-680529–, pp 186-218) A COMPARISON OF MURINE AND HUMAN LEUKEMIA. Sinkovics, J. G.; Shullenberger, C. C. (Anderson (M. D.) Hospital and Tumor Inst., Houston, Tex.); Gyorkey, F. (Veterans Administration Hospital, Houston, Tex.).

The pathogenesis and pathology of murine and human leukemia are similar but not entirely identical. Murine myelogenous leukemia originates in the spleen, whereas in man myelogenous leukemia begins in the bone marrow. Lymphocytic leukemia of the mouse originates in the thymus or in the mesenteric lymph nodes. In man all lymphoid tissue may serve as the site of origin. In both man and mouse, autoimmune phenomena may precede lymphocytic leukemia. Hodgkins' disease, Burkitt's tumorlike lymphomas, and Di Guglielmo type erythroleukemia with myelocytic proliferation occur in the mouse. Radiation-induced leukemia in the mouse may be either lymphocytic or myelogenous. All forms of murine leukemia, and some sarcomas, may be caused by a family of closely related viruses; these viruses possess RNA, measure 100 mμ in diameter, show no cubic symmetry, and leave the host cells by cytoplasmic budding without cytopathic effect. The exception is a Burkitt's tumorlike lymphoma, claimed to be caused by reovirus 3. Human leukemia contains virus particles similar to those of murine leukemia viruses; these particles failed to cause leukemia in mice, but recombination studies utilizing killed mouse leukemia viruses may prove that the human virus particles are related to the murine leukemia viruses. Suspension cultures of human lymphoid cells often harbor another virus resembling the viruses of the herpes group. Burkitt's lymphoma and infectious mononucleosis patients develop antibodies against this virus. Reovirus 3 was also isolated from cases of Burkitt's tumor. In tissue cultures, murine leukemic cells grow in suspension and continue to manufacture leukemia virus. In fibroblastic cultures, attenuation of the murine leukemia virus occurred. Some fibroblastic and epithelial cultures harboring a mouse leukemia virus undergo malignant transformation. Most human leukocytes grown in suspension manufacture the herpes-like virus. A few symbiotic cultures of large lymphoid cells and autochthonous elongated, epithelial, and multinucleated cells contain virus particles similar to the murine leukemia viruses. In murine leukemia, well-defined antibodies directed against leukemic cells or the leukemia virus are detectable. In human leukemia, an antigenic overlap between murine leukemia viruses and human leukemic antigens has been suggested. Antibodies reacting with reovirus or with the herpes-like virus also occur in certain types of human lymphoma. Chromosomal changes in murine leukemia appear as consequences of the disease. In human leukemia chromosomal changes may precede clinical leukemia. Clustering of Burkitt's lymphoma suggests infectious etiology. Other types of human leukemia may tend to cluster, but statistical analyses may not unequivocally suggest infectious origin. Murine leukemia does not spread horizontally by contact, but antibodies develop in cage mates of leukemic mice. Both viral and genetic factors dominate vertical transmission of murine leukemia. Virus-induced murine leukemia can be significantly prolonged by sublethal irradiation and administration of hematopoietic cells of donors immunized actively against the leukemia virus. When leukemia recurs after lethal irradiation and administration of immune hematopoietic cells, the virus shows little avidity to neutralizing antibodies. (auth)

585 (CONF-680529–, pp 219-41) MYELOPROLIFERATIVE DISEASE IN BEAGLE DOGS GIVEN PROTRACTED WHOLE-BODY IRRADIATION OR SINGLE DOSES OF ^{144}Ce. Fritz, T. E.; Norris, W. P.; Rehfeld, C. E.; Poole, C. M. (Argonne National Lab., Ill.).

Pure-bred beagle dogs, 10 to 15 months of age, were exposed to protracted whole-body γ radiation from a ^{60}Co source. They were kept in the radiation field at exposure rates of 72, 50, 35, 24.5, and 17 R/day. The exposure covered 22 hr of each day and were continued either until the animals died or for a maximum of 100 days. All dogs in the 17 R/day group survived the 100-day period of irradiation. Three of these dogs died at 29, 40, and 66 days after termination of exposure with leukopenia and anemia. Two of them had bilateral detachments of the retinas. Two more of the 17 R/day group died after a significantly longer period—305 and 402 days. These had localized infections that confounded the clinical and hematologic responses and the necropsy findings. There were myeloproliferative changes in many tissues of both animals, including the bone marrow, spleen, lymph nodes, and the choroid of the eyes. The proliferative cells showed a limited tendency to produce mature forms. The nature and distribution of these changes are those of a neoplastic disease and closely resemble anaplastic myelogenous leukemia. Exposures of 17 R/day for 100 days were converted to average absorbed doses in rads using results from ferrous sulfate dosimetry in dog-sized phantoms. The results show that these neoplasms were induced by 1275 rads to the whole body. Another group of similar beagles was given ^{144}Ce citrate intravenously in doses ranging from 22.8 to 253.0 μCi per kg of body weight. Those receiving the higher doses (above 50 μCi/kg) generally died within 100 days of bone marrow aplasia. There has been a high incidence of osteosarcomas at later times in dogs receiving the lower doses. One dog receiving 80.3 μCi/kg died 1198 days after injection following a short illness characterized essentially by leukocytosis and mild hypochromic anemia. The necropsy findings were typical of a leukemia; the histologic changes were similar to those in the ^{60}Co-irradiated dogs. (auth)

586 (CONF-680529–, pp 379-401) ^{90}Sr INDUCED HEMATOPOIETIC NEOPLASMS IN MINIATURE SWINE. Howard, E. B.; Clarke, W. J. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

A long-term study to ascertain the biologic effects of chronic exposure to radiostrontium in parent generations of miniature swine as well as their offspring has been underway at this laboratory for the past 10 years. To date, 716 animals have been placed on daily feeding of ^{90}Sr at dose levels ranging from 1 to 3100 μCi/day. Two hundred twenty-five littermates have served as controls. Pigs from each dosage level were killed at various time intervals to determine early effects, while the remainder were kept for lifetime observation, with periodic evaluations of hematologic and clinical chemistry parameters. Early lesions of the hematopoietic system included marrow necrosis, myelofibrosis, and myeloid metaplasia in potential marrow-producing organs. The highest levels of feeding resulted in acute radiation death. Hematopoietic neoplasms have developed in 51 pigs thus far. The histopathologic and hematologic studies in these animals have indicated a complete spectrum of these neoplasms, which mimics the morphologic appearance of spontaneous leukemias of man and animals. Although only 30% of the animals have developed frank leukemia, others have been subleukemic or have shown only a few blast cells in their peripheral-blood smears. The most frequent myeloproliferative condition was, as expected, myelogenous leukemia. Neoplastic myeloid elements proliferated and infiltrated the visceral organs as well as tissues and organs where this type of proliferation would not be expected. The cases ranged from very undifferentiated myeloblastic and stem-cell proliferations to granulocytic leukemia. Variants observed in the myeloproliferative-disease syndrome included several cases of myelomonocytic leukemia, granulocytic leukemia, basophil and eosinophil type, and erythroleukemia with a histologic appearance resembling Di Guglielmo's syndrome. Lymphoproliferative neoplasia was of a less frequent nature, but with similar widespread tissue destruction, and an occasional leukemic phase. These conditions were most often seen in the first- or second-generation offspring and from groups receiving lower feeding levels of ^{90}Sr. In two of the animals, there was a pronounced tendency for maturation to plasma cell type. In addition, one animal developed a thymoma. Several animals developed acute stem-cell neoplastic proliferations with little or no indication of maturation. It appears that the spectrum of hematopoietic neoplasms observed in these animals may be induced by the method of exposure and possibly by the radiation dose rate, or that the age at which critical damage occurs may determine the type of neoplasia that develops. (auth

587 (CONF-680529–, pp 517-32) TRANSFERABLE ^{90}Sr-INDUCED LEUKEMIA IN HOLTZMAN RATS. Jones, R. K.; Brooks, A. L.; Ferris, A. C.; Shaffer, D. K. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.).

Although common in some types of animals, spontaneous granulocytic leukemia is relatively rare in most strains of laboratory rats. However, exposure of rats to a chemical carcinogen and several forms of radiation has resulted in a significant number of cases of this type of myeloproliferative disorder. A number of such cases was observed in rats following exposure by inhalation to a soluble form of ^{90}Sr, and the biological characteristics of this type of leukemia have been studied following successful transfer to rat pups. The mean survival time following intraperitoneal transplant increases with decreasing cell concentration in the inoculum and with increasing age of recipient at time of transfer. Pathogenesis studies would indicate that transfer occurs by colonization rather than by viral induction, and a cytogenetic survey of leukemic cells on various generations reveals a consistent count of 44 rather than the normal number of 42 chromosomes. These features are compared with those observed in other studies in which the same type of neoplasm was induced by exposure of rats to methylcholanthrene, ^{227}Ac, and external x irradiation. On the basis of the gross morphologic appearance, cytological characteristics,

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and histochemical reactions, the method of induction appears to be relatively unimportant in determining the specific biological characteristics of resultant rat granulocytic leukemia. (auth)

588 (CONF-680529–, pp 703-20) COROLLARY STUDIES IN ^{90}Sr-INDUCED LEUKEMOGENESIS IN SWINE. Howard, E. B.; Hackett, P. L. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.); Ushijima, R. N.; Frazier, M. E. (Montana Univ., Missoula).

Immunologic deficiency was observed in miniature swine chronically fed ^{90}Sr. This find, along with electron microscope evidence suggesting the presence of virus particles in leukemic tissue and plasma, indicates an area requiring further research into leukemogenic mechanisms in a large laboratory mammal irradiated by an internal emitter. Cultured cells and viral isolation from these leukemic swine also indicated a viremic state with the presence of a virus, possibly passenger in nature, that may adapt to stable cultured cell lines. No significant chromosomal changes have been detected that could be incriminated in the leukemogenic process. A homoral- or leukocyte-associated factor was identified in certain leukemic swine, which had a significant effect on cultured normal hematopoietic cells. (auth)

589 STUDIES ABOUT THE EFFECT OF INTERVAL LENGTH IN FRACTIONATED IRRADIATION OF RABBIT TESTES. Leidl, W.; Zankl, H. (Univ., Munich). Strahlentherapie; 139: 548-52(May 1970). (In German).

The effect of time between two dose fractions in the fractionated x-irradiation of the testicles of the rabbit was studied. Eleven animals are forming the control group. They received single doses of 100 R, 200 R, 400 R (2 animals each time) or 800 R (5 animals), two receiving no irradiation. The fractionated dose was given to two groups of 8 animals each. They received either 200 R or 400 R as the first dose, followed by a second dose of 400 R after a time interval of 3, 6, 12, or 24 hours. The diameter of the seminiferous tubules is then compared. The seminiferous tubules of the irradiated animals are smaller than those of the control animals. A significant difference, however, is not observed between the doses of 100 to 800 R. A time interval of 24 hours results in a significant difference when compared to an interval of 3, 6, and 12 hours (first dose 200 R, $P < 0.01$). It was concluded that the time interval might have considerable influence on the radiological response. (auth)

590 EFFECT OF THYROID STIMULATING HORMONE AND RADIOPHOSPHORUS IRRADIATION ON THE BLOOD COMPONENTS OF HETEROPNEUSTES FOSSILIS BLOCH. Srivastava, P. N.; Nair, G. H. (Univ. of Rajasthan, Jaipur, India). Strahlentherapie; 139: 565-70(May 1970).

Indian catfish, Heteropneustes fossilis, weighing between 15 and 22 g were divided into two groups. Fish of one group received 0.5 mg bovine thyrotropin and of the other group received physiological saline. They were put in separate aquaria containing the same amount of water. ^{32}P was added to both the sets of aquaria to give approximately the same activity (3,500 cpm/ml). Red blood cells, white blood cells, hemoglobin, total protein, albumin and glucose were estimated in the blood. A higher concentration of the blood components was noted in the thyrotropin injected group showing that the degenerative changes caused by irradiation was improved by the action of thyroid stimulating hormones. (auth)

591 STATE OF VITAL ACTIVITY DURING PERIODS OF ACUTE RADIATION SICKNESS IN DOGS. Chaulytka, A. A.; Sidarenka, Ya. R.; Rabtsevich, T. S.; Lushnikau, Ya. F.; Lystsova, G. V.; Plenina, G. M. Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 1, 76-84(1970). (In Ukrainian).

The heart function of 92 dogs was studied by comparison of their electrocardiograms from this clinical laboratory with pathomorphological investigations that were made of the dynamics of acute radiation syndrome following whole-body irradiation (600R). The EKG investigations showed that changes of vital activity were developed along with other manifestations of acute radiation disease. Shifts in the EKG activities were noted within the first days after irradiation. The EKG indexes altered in proportion to the development of the illness reaching the greatest expression in the critical period in terminal animals (51 dog). The functional disturbance of vital activity during this period confirmed the pathomorphological investigations. At the same time, the EKG and histological investigations bore witness to the reversibility of the changes in the myocardial treated animals. In them was noted a reduction of the structure of fibres with small sclerotic changes without significant functional disturbances. (tr-auth)

592 RELATION OF THE OPTICAL DENSITY OF MITOCHONDRIA OF VITAL MUSCLE OF IRRADIATED ANIMALS TO THE FUNCTIONAL STATE OF THE HYPOTHALAMO-HYPOPHYSEAL-ADRENAL SYSTEMS. Nasirau, R. A. Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 1, 91-5(1970). (In Ukrainian).

The relation of the optical density of mitochondria of vital muscle of animals subjected to relatively small doses of radiation to the functional state of the hypothalamo-hypophyseal-adrenal systems was studied. (tr-auth)

593 EXPERIMENTAL STUDY OF THE RELATIVE BIOLOGICAL EFFECTIVENESS (RBE) OF TRITIUM OXIDE. Moskalev, Yu. I.; Zuraviev, V. F.; Kazbekova, D. A.; (and others) (Inst. of Biophysics, Moscow). Radiobiologiya; 10: 422-5(May-Jun 1970). (In Russian).

Rats were given single doses (0.6 to 9 mCi/g) of tritium oxide or were exposed to ^{137}Cs γ radiation for 4 and 12 days at dose rates that were initially comparable; the ^{137}Cs dose rates were lowered with time to simulate the tritium oxide dose regimen. Accounting for the biological half-life of tritium oxide, the RBE ranged from 1.35 to 2.0. Based on response of leukocytes and lymphocytes it was 1.9. (TSS) (JPRS)

594 SOME STUDIES ON THE BIOLOGICAL EFFECTS OF MAGNETIC FIELDS. Aceto, Henry Jr.; Tobias, Cornelius A.; Silver, Ira Lee (Univ. of California, Berkeley). IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 368-73(Jun 1970).

From 2nd European Conference on Hard Magnetic Materials, Milan, Italy. See CONF-690964.

The biological effects of radiation, including the possible effects caused by various gravitational states, on developing organisms and their interaction with radiation effects were investigated. Certain aspects of the studies along with a review of the observed effects of magnetic fields reported by others are also included. On the basis of these data, it is possible to speculate both on the association of magnetic field phenomena to the understanding of physiologic processes and on the possible deleterious effects these phenomena may have on the biological system. (46 references) (auth)

595 STUDIES OF COMBINATION INJURIES. BACTERIOLOGICAL STUDIES ON MICE INJURED BY WHOLE-BODY RADIATION AND OPEN SKIN WOUNDS. Messerschmidt, Otfried; Weis, Joachim (Univ., Freiburg i. B. Tierhygienische Inst., Freiburg i. B.). Strahlentherapie; 139: 594-602(May 1970). (In German).

Female mice received skin wounds, others were irradiated with 510 R, and others received a combined trauma. Blood, heart, liver, spleen, and kidneys of the animals were examined for bacteria as E. coli, staphylococci or streptococci. There is no relation between the number of bacteria and mortality. (auth)

Man

Refer also to abstracts 527, 532, 533, 536, and 564.

596 (CONF-680529–, pp 489-500) RADIATION AND MYELOPROLIFERATIVE DISORDERS IN MAN. Vaughan, Janet (Medical Research Council, Oxford (England). Bone-Seeking Isotopes Unit).

A myeloproliferative disorder is defined as abnormal hyperplasia of marrow cells with subsequent metastasis to other soft tissues, particularly the spleen, liver, and kidney. The possibility that lymphoid cells originating in the marrow may subsequently migrate elsewhere is not discussed. Clinically a myeloproliferative disorder is associated with severe anemia of a leukoerythroblastic type but not necessarily with a leukocytosis. Usually there is enlargement of both spleen and liver. There is acceptable statistical evidence based on human data that exposure to external radiation increases the incidence of myeloid leukemia in all age groups. There is no increase in classical lymphatic leukemia. Exposure of the fetus gives a marked excess of so-called "acute leukemia" sometimes classified as lymphoblastic. The cells affected by this leukemic process in the fetus in man and pig may well be an embryonic cell present in the marrow as well as a cell already differentiated toward a myeloid form. Radium-226, an alpha-emitting bone-seeking radionuclide that irradiates primarily osteogenic tissue rather than marrow, is not recorded as giving rise to any excess of myeloid leukemia. Phosphorus-32, used to treat polycythemia vera, irradiates both osteogenic and myeloid tissue. Follow-up data suggest a significant increased incidence of acute myeloid leukemia and myelosclerosis in patients receiving ^{32}P rather than chemotherapy. It cannot yet be concluded that significant numbers of osteogenic tumors may not still appear in the Japanese casualties, the spondylitics, the patients treated with ^{32}P,

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or the Hanford pigs. Experience both with man and pig has been too short. (auth)

597 STATE OF FIBROUS STRUCTURES IN CHRONIC RADIATION ULCERS OF THE SKIN. Kostyukovskii, I. M.; Kolesnikova, G. S. (Kharkov Research Inst. of Medical Radiology). Med. Radiol.; 15: No. 7, 43-9(Jul 1970). (In Russian).

Changes of fibrous structures of the skin in the zone of chronic radiation ulcers were studied in 88 patients. Significant disturbances of these structures of the connective tissue were observed. The intensity of changes was more marked in cases with a prevalence of necrotic processes in the affected areas. Alteration of collagenous and argyrophil fibers spread to a greater distance from the center of the lesion than elastic fibers. The maturation of granulation tissue in the radiation ulcer leads to the development of an inadequate scar. (auth)

598 PATHOLOGICO-ANATOMICAL CHANGES OCCURRING IN RADIATION TREATMENT OF ESOPHAGEAL CANCER. Savchenko, E. D.; Kozlova, A. V.; Garvei, N. N. (Moscow Research Inst. of Roentgen-Radiology). Med. Radiol.; 15: No. 7, 3-8(Jul 1970). (In Russian).

Forty-seven autopsy cases of esophageal carcinoma after teleradiation therapy in 536 patients were presented. In most cases radiation therapy destroyed primary tumor of the esophagus resorption with replacement by connective tissue followed. Ulcers were formed at the edges or bottom of which the tumor remained. Mucosa forming in some cases at the site of the former tumor macroscopically differed little from nonaffected areas of the esophagus. Restoration of the epithelial layer of the esophagus in rational radiation therapy masked the former neoplastic tumor and only meticulous histological study sometimes at a distance from the ulcer revealed separate complexes of cancerous cells. Roentgeno-anatomical study of the esophagus, where prior to irradiation the tumor was situated, may lead to a wrong conclusion on complete reverse development and even cast a doubt on the primary diagnosis. At the same time the presence of radiation ulcer may sometimes be viewed as cancer relapse and lead to repeated irradiation, which is tactically not permissible, for it may be the cause of perforation and death. A study of the esophageal wall at diverse distances from cancer showed groups of mitotically active neoplastic cells. This may explain the appearance of relapses in such patients after apparently favorable treatment. (auth)

599 DIAGNOSIS AND TREATMENT OF RADIATION-INDUCED STENOSIS OF THE SIGMA. Overbeck, W.; Birzle, H. (Univ., Freiburg i. B.). Therapiewoche; 20: 1256; 1259-60(1 Jul 1970). (In German).

Stenosis of the colon can be expected to occur at doses in excess of 4000 R and perforation at doses in excess of 6000 R for gynecological therapy. The latent period between radiation and manifestation of clinical symptoms averages 4 to 5 months. Diagnostic radiography shows smooth contours of the colon without larger filling defects as found in tumor recurrence. Radiation-induced stenosis of the sigma should be corrected surgically as soon as possible. If diagnosed early, resection of the stenosed part followed by end to end connection proves successful. (H.B.G.)

600 RADIATION INJURY TO THE INTESTINE WITH ILEUS COMPLICATIONS. Schier, J. (Univ., Mainz). Therapiewoche; 20: 1261; 1264-5(1 Jul 1970). (In German).

From 1964 to 1969, fifteen patients were surgically treated for ileus caused by radiation injury. The stenosis, occurring several months to 20 years following radiotherapy was located either in the region of the distal ileum or the sigma. Since frequently the intermittent nature of the ileus was interpreted as recurrence of cancer, surgical treatment was delayed. On resection, hyalinization of connective tissue was found as well as thickening of vessel intima. In all cases, successful surgical treatment could be performed and in only one patient metastatic tumor was found. (H.B.G.)

601 IRRADIATION NEPHRITIS. Foldes, Gyula; Magyar, Eva; Hollo, Tamas (Inst. of Postgraduate Medical Education, Budapest). Orv. Hetil.; 111: 927-30(19 Apr 1970). (In Hungarian).

The case of a 10-year-old boy is reported who suffered from acute lymphoblastic leukemia and succumbed to it. The irradiation therapy used for the underlying disease led to severe damage of the kidneys, which proved to be subacute irradiation nephritis according to clinical, pathologic-anatomical, and pathohistological findings alike. In association with a detailed analysis of the case, a literature survey on the problem is also presented. (JPRS)

602 ACQUIRED RADIORESISTANCE OF TUMORS IN EXPERIMENT. Balmukhanov, S. B.; Efimov, M. L. (Leningrad Research Inst. of Tuberculosis). Med. Radiol.; 15: No. 7, 79-86(Jul 1970). (In Russian).

Radioresistance of tumors following their repeated irradiations is reviewed. Data are given on the shifts in neoplasms with increased radioresistance and ways of rise of the resistance to the effect of radiation. (auth)

Radiation Effects on Plants

Refer also to abstracts 494, 503, 504, 506, 515, and 516.

603 RESPONSE OF WHITE SPRUCE (PICEA GLAUCA (MOENCH) VOSS) SHOOT APICES TO EXPOSURES OF CHRONIC GAMMA RADIATION. Cecich, Robert A.; Miksche, Jerome P. (Dept. of Agriculture, Rhinelander, Wis.). Radiat. Bot.; 10: 457-67(Sep 1970).

Four-year-old trees of white spruce (Picea glauca (Moench) Voss) were exposed to chronic gamma irradiation at exposures ranging from 0.5 to 30.0 R/20-hr day for one growing season. The LD_{50} for shoot growth was about 28 R/20-hr day. The apical initials were the first cells to show radiation damage. The central mother cell zone was the next most sensitive region. Needle primordia formation decreased with increased exposure rates, with an LD_{50} of 2.0 R/20-hr day. The controls appeared to indicate that volume of the central mother cell zone was related to production of needle primordia, but this was disproved in the treated material when needles were produced in apices having no central mother cell zone. (auth) (UK)

604 RESPONSE OF SINAPIS ALBA TO IRRADIATION IN DIFFERENT GROWTH MEDIA. Cawse, P. A.; Radley, J. H. (United Kingdom Atomic Energy Authority, Wantage, Eng.). Radiat. Bot.; 10: 491-3(Sep 1970).

The effect on dry matter production of 5 and 10 kR irradiation in white mustard (Sinapis alba) established in soil was found to be small. Where the plants were cultured in a biologically inert medium with added nutrients however severe reduction in yield occurred. Results are tabulated. This variability in behavior following irradiation under different culture conditions suggests that the quality of plant growth media demands stricter control for many radiobotanical investigations, especially where weight of tissue is a criterion of response. (UK)

605 RELATIVE SENSITIVITY OF THE SOAKED SEEDS OF NINE GYMNOSPERM SPECIES TO GAMMA RADIATION. Rudolph, T. D.; Miksche, J. P. (Dept. of Agriculture, Rhinelander, Wis.). Radiat. Bot.; 10: 401-9(Sep 1970).

Seeds of nine gymnosperm species, soaked in water to full imbibition, were irradiated with ^{137}Cs gamma rays in two separate experiments. Species studied were Larix laricina, Picea abies, Picea glauca, Picea mariana, Pinus banksiana, Pinus contorta, Pinus resinosa, Pinus sylvestris and Thuja occidentalis. In the first experiment exposures of 150 to 38,400 R were used and the seedlings were grown for 36 days after initial germination in perlite saturated with a complete nutrient solution. In the second experiment exposures of 150 to 19,200 R were employed and the seedlings were grown in sand for 75 days after initial germination. Endpoints scored in the first experiment were germination, survival, cotyledon length, and plant dry weight. In the second experiment germination, survival, hypocotyl length, cotyledon length, shoot length, root length, shoot dry weight, and root dry weight were scored. Seed radiosensitivity varied by a factor of 3.80 to 7.33 in the first experiment and from 2.67 to 5.70 in the second experiment, depending on the endpoint used. Comparison of the results with previous reports for individual species indicated that relative radiosensitivity of seed of plant species must be investigated with all species of interest being identical in radiation exposure conditions, seed moisture content and post-irradiation storage. Germination and growing conditions optimal for each species are suggested. (auth) (UK)

606 VARIATION IN NUCLEAR CHARACTERISTICS IN SELECTED WESTERN CONIFERS AND ITS RELATION TO RADIOSENSITIVITY. El-Lakany, M. H.; Sziklai, O. (Univ. of British Columbia, Vancouver). Radiat. Bot.; 10: 421-7(Sep 1970).

Nuclear characteristics of Interior Douglas-fir, Coastal Douglas-fir, Sitka spruce and Western hemlock were investigated and correlated with LD_{50}'s. Significant differences were found among the species in nuclear volume (N.V.), interphase chromosome volume (I.C.V.), DNA content per cell, and DNA content per chromosome with Sitka spruce having the highest values. The correlations between LD_{50} (germination) and N. V. and between LD_{50} (germination) and I.C.V. were not significant. Highly significant negative correlations were found between LD_{50} (germination) and both DNA content per cell and DNA content per chromosome. The

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differences in nuclear characteristics between the coastal and interior forms of Douglas-fir are discussed in relation to their distribution and taxonomy. (auth) (UK)

607 EFFECTS OF GAMMA-IRRADIATION ON SOME WESTERN CONIFERS. El-Lakany, M. H.; Sziklai, O. (Univ. of British Columbia, Vancouver). Radiat. Bot.; 10: 411-20 (Sep 1970).

The radiosensitivity of Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco), from two provenances representing the coastal and interior regions in British Columbia, Sitka spruce (Picea sitchensis (Bong.) Carr.), and Western hemlock (Tsuga heterophylla (Raf.). Sarg.), was investigated through the effects of gamma irradiation on seed germination, seedling growth and survival. The species exhibited differential responses to seed irradiation and all were injured at the higher dosages (5000–10,000 rad). Stratification after irradiation reduced seed germination and seedling growth and survival. The tolerance to gamma irradiation decreased in the following order: Interior Douglas-fir, Coastal Douglas-fir, Western hemlock and Sitka spruce. The possibilities of utilizing seed irradiation in forest tree improvement are discussed and recommendations are made for future mutation breeding work. (auth)

608 DIFFERENT EFFECT OF POLYPLOIDY ON RADIATION RESPONSE AND ON AGING OF DIFFERENTIATED CELLS. von Wangenheim, K.-H. (Nuclear Research Establishment, Juelich, Ger.). Radiat. Bot.; 10: 345-50(Jul 1970).

Genetic redundancy (autopolyploidy) decreased radiosensitivity to a considerable extent after x irradiation of leaves in four different plant species. Accordingly, radiation damage of differentiated (non-dividing) cells depends primarily on genetic defects (hits). It is suggested that lack of differences in radiosensitivity between diploids and corresponding autotetraploids, as observed in other cases, is due to a preponderance of other effects not directly depending on irreversible genetic defects (inhibition of mitosis). The radiation response of leaves is similar in appearance to natural aging as is frequently observed in zoological material after irradiation. Unirradiated leaves of diploid and autotetraploid plants, however, do not differ significantly in time of survival. In accordance with other examples, this observation indicates that an accumulation of spontaneous nuclear mutations, as is suggested by the mutation theory of aging, does not cause natural aging. Indications for the significance of cytoplasmic processes in senescence are discussed. (auth) (UK)

609 INFLUENCE OF X-IRRADIATION AND SEED-MOISTURE ON NUCLEIC-ACID AND PROTEIN METABOLISM IN BARLEY. Joshi, R. K. (Bhabha Atomic Research Centre, Bombay); Ledoux, L. Radiat. Bot.; 10: 437-43(Sep 1970).

Seeds with varying moisture content (3 to 4%) were x-irradiated with doses of 0, 10, 12.5, and 15 kR. Radioinduced changes in the length of root and shoot, and their fresh and dry weights indicate that the seeds show maximum radioresistance at intermediate moisture levels and that the shoot is more sensitive to x-rays than the root. There was no significant modification of DNA, RNA, and acid soluble (AS) content while protein content was adversely affected by radiation irrespective of seed moisture. However, no change in total macromolecular content could be detected in the plant as a whole. (auth) (UK)

Radiation Effects on Microorganisms

Refer also to abstracts 498, 513, 594, 610, and 611.

Radiosterilization and Radiopreservation

Refer also to abstract 140.

610 PRELIMINARY RESULTS CONCERNING THE PRESERVATION OF FRESH TOMATOES (LYCOPERSICUM ESCULENTUM MILL) BY GAMMA RADIATION. Huque, Heshamul; Khaleque, Mohammad Abdul (Ministry of Agriculture and Works, Karachi, Pakistan). Food Irradiat.; 10: 25-9(Apr-Jun 1970). (In French).

Undamaged tomatoes were irradiated at 24 to 32°C with doses of 2, 5, 7, 10, 15, and 20 Krads (55 to 72% relative humidity). A similar amount of fruit was kept as a standard. The changes in the color of the tomatoes and the fungi growing on them (saprophytes) were examined. Radiation doses from 7 to 10 Krad produced the greatest preservation time: 39 days compared to 18 days for the standard. Fungi Fusarium constitute the most detrimental agents in tomato rot during their storage. (auth) (France)

611 SALMONELLA INHIBITION BY IRRADIATION OF EVAPORATED EGG POWDER. Bomar, M. T. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Arch. Lebensmittelhyg.; 21: No. 5, 97-102(May 1970). (In German).

Egg powder was inoculated with Salmonella typhimurium. Radiation doses of 10 to 1000 krad were applied. The irradiation facility used was a linear accelerator operated at 10 MeV. The following results were obtained: enrichment culture media and selection culture media yielded more or less the same results. The Salmonella number decreased by 250 krad to 1% and by 500 to 1000 krad to less than 0.1%. The damaging process continued during the storage after irradiation. Growth could still be detected 4 and 24 hr after irradiation with 1000 krad but after 8 days no viable germs were found. The age of the germs has no effect on radioresistance. During irradiation certain products seem to be formed that have a toxic effect on microorganisms and have a long lifespan depending on the water content of the milieu. (INIS)

612 STUDY OF RADIOSTERILIZATION OF AN OPHTHALMIC OINTMENT CONTAINING HYDROCORTISONE AND CHLORAMPHENICOL. II. EXAMINATION OF THE OINTMENT BASE CONSTITUENTS. Hangay, Gyorgy (Pharmaceutical Works of Kobanya, Budapest). Acta Pharm. Hung.; 40: No. 2, 75-80 (Mar 1970). (In Hungarian).

The ointment base constituents white, soft paraffin, liquid paraffin, cetylalcohol, and propylene glycol were irradiated with 2.5, 5.0, and 10.0 Mrad doses. The physical and chemical properties of the irradiated substances had been investigated using several methods and the results were compared with those of the untreated samples. The results are evaluated from the standpoint of introducing gamma-sterilization techniques for ophthalmic ointments. (JPRS)

613 GAMMA RADIATION EFFECT ON THE BEHAVIOR OF HARVESTED TOMATOES. Sattar, Abdus; Mumtaz, Ali; Muhammed, Amir (Atomic Energy Centre, Lahore). Food Irradiat.; 10: 21-5(Apr-Jun 1970). (In French).

The ripening of irradiated (100–500 Krad) and nonirradiated tomatoes was studied and biochemical analyses were made during their storage. Irradiated tomatoes ripened slower; a retardation in ripening of 2 to 4 days was observed in a few cases for 200 to 400 Krad doses. Irradiation reduced the ascorbic acid content, but did not significantly modify the sugar content. The preservation of pectins in the form of soluble pectin enhanced at higher radiation doses (400 to 500 Krad). (auth) (France)

METALS, CERAMICS, AND OTHER MATERIALS

Metals and Alloys

Refer also to abstract 351.

614 (ORNL-4270(Vol.2)) BIBLIOGRAPHY OF THE TECHNICAL LITERATURE OF THE METALS AND CERAMICS DIVISION FOR 1969. Hill, Meredith R. (comp.) (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 69p. Dep. NTIS.

A bibliography containing 220 separate citations is presented. The citations are in order under a master chronological listing in which each entry is given in complete bibliographical form. A subject index, author index, list of theses, list of patents, ORNL numbered topical reports, and ORNL numbered Technical Memorandum reports are included. (J.R.D.)

Corrosion and Erosion

Refer also to abstracts 304 and 1851.

615 (AD-708573) OXIDATION MECHANISM OF ZIRCONIUM. Final Report, May 15, 1967-May 14, 1970. Keneshea, Francis J. (Stanford Research Inst., Menlo Park, Calif.). 24 Jun 1970. Contract DAHC04-67-C-0055. 5p. (AROD-7098:2-MC). NTIS.

Research carried out on determination of the oxygen deficiency in ZrO (2-x) in equilibrium with oxygen-saturated Zr is summarized. Studies of the diffusion of oxygen in zirconia, and a test of the applicability of the results to theoretical models of the defect structure are reported and determination of the oxygen deficit at which the mole fractions of free electrons and anion vacancies are equal is described. (USGRDR)

616 (AD-829844) CORROSION RATES OF URANIUM ALLOYED STEEL IN MARINE HYDROSPACE. Brouillete, Carl V. (Naval Civil Engineering Lab., Port Hueneme, Calif.). Feb 1968. 23p. (NCEL-TN-950). NTIS.

Corrosion rates in the 3 hydrospace environments were primarily controlled by the dissolved oxygen concentrations and to a lesser extent by temperature. Segregation of uranium in the steels, which possibly could have occurred during production, could not be detected. Profuse micro-pitting over the surface of the uranium alloyed stainless steel was attributed to the uranium. Corrosion rates of steel in deep ocean were low. (auth) (USGRDR)

617 (BNWL-1349-2, pp 9.1-) ATR WATER LOOP OPERATION AND MAINTENANCE. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

The ATR water loop operated during the second quarter of CY 1970 at 2000 psig, 520°F, containing stainless steel tensile specimens, Zircaloy corrosion specimens, and pressure vessel steel Charpy V-notch specimens. (auth)

618 (EUR-4507) CONTRIBUTION TO THE STUDY OF THE MECHANISM OF OXIDATION OF PURE OR ALLOYED ZIRCONIUM BY OXYGEN AND STEAM. Leclercq, M. (Institut CNRS de Recherche sur la Catalyse, Villeurbanne (France)). 1970. 174p. (In French). Dep. NTIS (U. S. Sales Only). EUR FF 16,50.

Results of a microgravimetry and metallography study of the oxidation of zirconium and Zircaloy-2 under oxygen pressures or partial steam pressures of 6, 10, and 16 torr at 600 to 800°C are presented. Results of a study on a zirconium filament under reduced air or oxygen pressure are also presented. (auth)

619 (TID-25554) THE RELATIONSHIP OF NITROGEN CONTENT TO THE SUSCEPTIBILITY AUSTENITIC STAINLESS STEELS TO STRESS CORROSION. Quarterly Report No. 1, June 1, 1970-August 31, 1970. Clevinger, G. S.; Lytton, Jack L. (Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering). Sep 1970. Contract AT(40-1)-4052. 13p. Dep. NTIS.

Work during the quarter is summarized. As-received Type 304 material was examined both metallographically and with the electron microscope. Methods of specimen preparation were developed and tested, and characteristic data were collected, including those on electron diffraction. The gas-nitriding apparatus was refurbished and recalibrated and preparations were made for initial production of increased-nitrogen alloys. Supplies and equipment were collected and tested where necessary. Specimens of as-received Type 304 were cut to standard test dimensions and given various amounts of tensile deformation using an Instron machine. The substructural dislocation configurations produced are being examined in the electron microscope and compared with the configurations produced in the fully annealed state. Preliminary designs have been considered for apparatus which will have the capability for stress corrosion testing of austenitic stainless steel specimens having increased nitrogen contents under conditions of static tensile loading. (auth)

620 IMPROVEMENTS IN PICKLING BATH COMPOSITIONS. Board, John Andrew; Parkashjain, Darshan (to United Kingdom Atomic Energy Authority). British Patent 1,206,756. 30 Sep 1970. Filed 27 Jan 1967.

Reference is made to pickling fluids suitable for the surface treatment of objects fabricated from Zr-based alloys. Present techniques for the fabrication of such objects result in a layer of work hardened and contaminated metal which may extend to an appreciable depth, and under conditions such as obtain in a nuclear reactor this may result in a rapid corrosion rate. Pickling to remove the surface layer by chemical dissolution, followed by subjection of the cleaned surface to the action of high pressure and high temperature steam, gives rise to a normally firmly adherent oxide coating giving good protection against corrosion. Pickling compositions at present in use are not entirely satisfactory, however, for some Zr alloys, such as Zr/Nb. The pickling solution described consists of 4 to 5% by volume of 40% wt./vol. HF, 30 to 40% by volume concentrated HNO_3, and 15 to 20% by volume of concentrated H_2SO_4. Pickling is preferably carried out at ~30°C. (UK)

621 OXIDATION KINETICS OF DISPERSION-STRENGTHENED NICKEL-ZIRCONIA ALLOYS. Rao, T. Hanumantha; Vasu, K. I. (Indian Inst. of Science, Bangalore). Indian J. Technol.; 7: 268-73(Sep 1969).

Nickel-zirconia dispersion-hardened alloys have been found to exhibit high oxidation resistance. In the temperature range 700 to 950°C, the basic mechanism of oxidation of nickel-zirconia alloys is not much different from the mechanism of oxidation of pure nickel. Generally, a simple logarithmic law is applicable to the initial oxidation of these alloys, which is followed by a parabolic rate law. The rate constants for the logarithmic as well as the parabolic stages of oxidation have been evaluated and found to obey an Arrhenius type of equation for its temperature dependence. The activation energy for the initial logarithmic oxidation is found to be 19.0 ± 2 kcal/mole; this represents a phase-boundary reaction, identified as an adsorption process. The activation energy for the parabolic oxidation is 43.0 ± 2 kcal/mole, which is close to some of the values reported for the oxidation of pure nickel and, therefore, involves the same mechanism of oxidation. (auth)

622 REACTION KINETICS OF DRY CORROSION IN PULVERULENT OR PLATED ZIRCONIUM BY HYDROGEN SULFIDE. Toesca, Serge; Colson, Jean-Claude (Dijon Univ., France). Compt. Rend., Ser. C; 271: 436-9(17 Aug 1970). (In French).

The sulfidation of pulverulent or plated zirconium between 530 and 790°C under a pressure of hydrogen sulfide between 1 and 150 torr gives rise to the nonstoichiometric disulfide ZrS_2. The global reaction rate is determined by the molecular diffusion of hydrogen sulfide in the porous sulfide layer. (auth) (France)

623 VARIOUS FACTORS INFLUENCING THE CORROSION OF ZIRCONIUM/VANADIUM ALLOYS IN WATER AND STEAM. Borchers, H.; Wagner, G. (Technische Hochschule, Munich). Werkst. Korros.; 21: 319-35(May 1970). (In German).

Several factors were studied with respect to corrosion of zirconium and zirconium-vanadium alloys in water and saturated steam. Through microscopic observations and weight measurements the following factors were analyzed: corrosion medium, surface condition, properties of the sponge zirconium used as basic material, vanadium concentration, and temperature. Fluoride residues from etching media caused such a scattering of experimental results that polished samples were preferred. Sponge zirconium corresponded in corrosion behavior with that of iodide zirconium. With increasing vanadium concentration, corrosion resistance was reduced. In the temperature range from 250 to 350°C, vanadium alloys increased their weight linearly with time; the time constants were determined. (tr-auth)

624 EFFECTS OF RADIATION ON THE CORROSION OF SOME Zr ALLOYS. Asher, R. C.; Davies, D.; Kirstein, T. B. A.;

XUM

McCullen, P. A. J.; White, J. F. (Atomic Energy Research Establishment, Harwell, Eng.). Corros. Sci.; 10: 695-707(Oct 1970).

Under certain circumstances reactor irradiation enhances the corrosion of Zircaloy-2 and of Zr-2½% Nb alloy by 10-fold or more. The enhancement is most significant in the post-transition region and in the temperature range 250 to 350°C; in the pre-transition region Zr-2½% Nb alloy sometimes shows a slight suppressing effect of radiation. The detailed corrosion behavior and the internal surface area of the oxide depend, inter alia, on whether the corrodent is "gaseous" (i.e., steam or impure carbon dioxide) or "liquid" (i.e., water); mechanisms to account for these observations are discussed. (auth) (UK)

625 ELECTRODEPOSITED NICKEL AS A PROTECTIVE COATING FOR URANIUM IN UNSATURATED AIR NEAR AMBIENT TEMPERATURE. Owen, L. W.; Alderton, J. R. (Atomic Weapon Research Establishment, Aldermaston, Eng.). Brit. Corros. J.: 5: 217-26(Sep 1970).

The protective merit of electrodeposited coatings, mainly nickel or uranium, was assessed in air at 60° and 80° relative humidity over long-term exposure on a weight-gain basis. Factors likely to influence performance were studied and included surface preparation, type of bath, coating thickness, supplementary coatings, post-deposition treatments, etc. Results indicated the importance of surface preparation, a satisfactory degree of protection being obtained consistently only on etched uranium surfaces. It also appeared to be essential to maintain a wetting agent in the nickel-plating bath and to keep coating thickness above a certain minimum. With the best coatings there was no detectable weight gain even after six months exposure while with the worst not only was there no protection but the corrosion rate of the underlying uranium was enhanced. In the intermediate range of performance, most coatings behaved well initially but protection decreased with time of exposure. Protection decreased very rapidly if the coating (not pore-free) was unbonded while breakdown rates of well-bonded coatings could be almost imperceptible at low porosity levels. Highly porous coatings, such as are frequently obtained at low thickness, offered little protection at an early stage of exposure even when well bonded. (auth) (UK)

Preparation and Fabrication

Refer also to abstract 1.

626 (AD-480455) HIGH-PURITY METALS. Rengstorff, George W. P. (Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center). 3 Jan 1966. Contract AF33(615)-3408. 75p. (DMIC-222). NTIS.

The production and availability of thirteen high-purity metals are discussed. Information about the purest available polycrystalline and single crystal forms of each of the metals is presented. Also included is information about less pure forms of the metal usually including a grade which might be defined as commercially pure. Some of the newer techniques for analyzing or characterizing the purity of the metals are discussed without including methods of chemical analyses. The thirteen metals covered by this report include the refractory metals molybdenum, tungsten, niobium, tantalum, and rhenium: special light metals, beryllium, and titanium and metals with an intermediate melting point, iron, nickel, chronium, vanadium, and zirconium. The semi-metal, boron, is the thirteenth element. Individual sections for each of the metals are presented in alphabetical order. (USGRDR)

627 (AD-821672) POWDER METALLURGY OF BERYLLIUM. Porembka, S. W.; Hanes, H. D.; Gripshover, P. J. (Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center). 15 Oct 1967. Contract AF33(615)-3408. 26p. (DMIC-239). NTIS.

The powder metallurgy of beryllium from the preparation of powders through the production from the powders of solid products is discussed. Various methods of powder compaction are presented including die pressing, isopressing, slip casting, vibration packing, and explosive compaction. Sintering, and methods of elevated temperature consolidation, including vacuum hot pressing, hot isostatic pressing, forging, extrusion, and plasma spraying are discussed. Properties of powder beryllium products, applications of beryllium prepared by powder metallurgy and current trends in the powder metallurgy of beryllium are also covered. (auth) (USGRDR)

628 (BNWL-1349-2) REACTOR FUELS AND MATERIALS DEVELOPMENT PROGRAMS FOR FUELS AND MATERIALS BRANCH OF USAEC DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY. Quarterly Progress Report, April-June 1970. Sheely, W. F. (ed.) (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug 1970. Contract AT(45-1)-2170. 311p. Dep. CFSTI.

Research progress is reported in eight sections. A separate abstract was prepared for each section. (J.R.D.)

For abstracts of individual sections see: 340, 617, 703, 704, 720, and 775-777.

629 (CONF-700403-(Vol.2), pp 545-56) PROPER HANDLING OF RARE EARTH METALS AND ALLOYS FOR LATTICE PARAMETER STUDIES. Spedding, F. H.; Beaudry, B. J. (Iowa State Univ. of Science and Technology, Ames).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume II. Sessions I through M.

A thorough investigation of the preparation and annealing of filings of erbium under various conditions was carried out. It was shown that filings prepared under carbon tetrachloride, under purified argon, or in air, gave higher lattice parameters than those observed on as-sublimed metal. A series of experiments were carried out which showed the filings were being contaminated by interstitial impurities such as O, H, N, and C. To prevent this contamination a method was developed to produce small grained wires which could be used for x-ray analysis. The lattice parameters of the other rare earth metals were also redetermined using the wire technique. (auth)

630 (CONF-700403-(Vol.2), pp 557-67) PREPARATION OF ^{147}Pm METAL AND DETERMINATION OF THE DENSITY AND MELTING POINT. Wheelwright, E. J. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume II. Sessions I through M.

Four 30-g buttons of ^{147}Pm metal have been prepared by Ca reduction of anhydrous $PmCl_3$. Additional purification was obtained by vacuum distillation of Ca and Mg impurities. The density of the metal was found to be 7.22 ± 0.03 g/cm and the melting point is 1168 ± 6°C. (auth)

631 (INR-1194) POLISH-ITALIAN SEMINAR ON SOME CHEMICAL, CERAMIC, AND METALLURGICAL ASPECTS OF NUCLEAR FUELS. Summaries: Zakopane, 29 May-2 June 1970. (Institute of Nuclear Research, Warsaw (Poland)). 1970. 34p. (CONF-700540-(Summ.)). Dep. NTIS (U. S. Sales Only).

Summaries of 46 papers are included on processing fuels, analytical methods, separation processes, fuel fabrication processes, and fission product behavior. (J.R.D.)

632 METALLOGRAPHIC PREPARATION OF ZINC-TUNGSTEN COMPOSITES. Koch, Rosemarie (Stanford Univ., Calif.). Prakt. Metallog.; 7: 522-6(Sep 1970). (In English and German).

Methods for preparing zinc-base metal composites with tungsten for metallography, are described. Microsections were ground wet on SiC papers followed by polishing with soft wool cloth and electrolytic lapping. A final touchup using gamma phase Al_2O_3 is used. An electron micrograph of a specimen treated by these methods reveals 1 to 5 μm grain size for zinc, and up to 2 μm diameter for tungsten grains. (J.R.D.)

633 ELECTRODEPOSITION OF INDIUM ON BISMUTH AND INDIUM-BISMUTH CATHODES. Peraldo Bicelli, L.; Romagnani, C.; Serravalle, G. Electrochim. Metal.; 4: 233-44(Jul-Sep 1969). (In Italian).

Electrostatic and electrokinetic measurements were undertaken on Bi and In-Bi cathodes in a special cell during deposition of In from $InCl_3$ solution. Deposits were studied by x-ray diffraction. The results indicated depolarization of the cathode during electrolysis; the formation of BiIn and $BiIn_2$ was shown to be responsible for this effect. Diffusion of In into the cathode was also demonstrated. (Metals Abstr.)

634 PRODUCTION OF Al-Th AND Al-Th-U ALLOYS BY REDUCTION OF ThO_2 AND U_3O_8 BY LIQUID ALUMINUM. Canocchi, Jose Deodoro Trani; Gentile, Erberto Francisco; Tracanella, Roberto Barata. Metalurgia (Sao Paulo); 25: 831-42 (Nov 1969). (In Portuguese).

Methods of preparing fuel materials for nuclear reactors emphasizing direct reduction of ThO_2 to metallic Th incorporated in an Al-Th alloy, using Al or an Al-Th alloy as the reducing agent in a liquid metal-slag system are described. Micrographs are shown of Al-Th-U alloys produced by remelting of Al-Th and Al-U alloys in a used cryolite. The process described for the Al-Th alloys bypasses the fluoridation of ThO_2 to ThF_4, the subsequent reduction of this salt to Th and, of course, the preparation of alloys by simultaneous melting of Th and Al. The effects of variables on reduction efficiency ratio between mass of cryolite and mass of ThO_2, initial concentration of Al_2O_3 in the cryolite, reaction time and temp. and the concentration of Th in the re-

ducer when the latter is an Al–Th alloy rather than Al only are reported. An experiment in which ThF_4 was substituted for the ThO_2 as the source of Th is cited as having produced a Th-rich Al–Th alloy (52% Th). The thermodynamic principles of the reduction of ThO_2 by Al in a metal-slag system are reviewed. (Metals Abstr.)

635 INTRODUCTION TO GAS-JET LASER CUTTING. Adams, M. J. Metal Constr. Brit. Weld. J.; 2: 1-8(Jan 1970).

The CO_2–O laser can be used to cut mild and alloy steels, Ni- and Co-based alloys, Ti alloys, Zn, Pb, Ta, and Nb, though at present it is a thin section cutting process. The width of the cut is limited to the dia of the spot, the gas jet removes the molten oxides, the spot has a high energy density and the total heat input is low, so that the heat affected zone is narrow. (Metals Abstr.)

636 URANIUM PRODUCTION AND SHORT-TERM REQUIREMENTS. Mackenthun, Werner (Vereinigung Deutsche Elektrizitaetswerke eV, Frankfurt am Main). At. Strom; 16: 121-6(Aug 1970). (In German).

Results of investigations commenced years ago into stocks available and requirements for uranium and thorium in the world were checked and corrected in accordance with the rapidly increasing generation of nuclear energy, and the fuel required. Even these data are probably somewhat out-of-date for some countries due to prospecting which has taken place in the meantime; in any case a more optimistic view can be taken of the world supply of nuclear fuels, and this is shown by the fairly steady price level on the world market. (auth)

637 MECHANISM UNDERLYING THE DISSOLUTION OF THE TUNGSTEN CARBIDE–COBALT ALLOY VK8 IN THE COURSE OF ELECTROCHEMICAL MACHINING. Levin, A. I.; Evseeva, M. A.; Nechaev, A. V.; Solov'ev, Yu. P. Elektron. Obrab. Mater.; No. 4, 23-6(1969). (In Russian).

The mechanisms underlying the dissolution of a WC–Co (VK8) alloy during electrochemical machining are discussed in the light of impedance measurements and kinetic thermal analysis. The first stage of passivation of the material under these conditions is of an adsorption nature. The second stage involves the formation of a true oxide film on the surface. These conclusions are supported by polarization curves obtained for pure Co, WC, and the WC–Co alloy in NaCl and other electrolytes. (Metals Abstr.)

638 SOME CHARACTERISTICS OF THE ALLOYING OF METALLIC SURFACES IN VACUUM. Lazarenko, N. I.; Lazarenko, B. R.; Bakal, Sh. Z. Elektron. Obrab. Mater.; No. 4, 27-30(1969). (In Russian).

The kinetic characteristics of the surface alloying of metal plates by the electric-spark method are discussed in the light of experimental measurements on the continuity and microhardness of the layers so deposited and the total weight increment. The plates were of C-steel and the surface material Cu, Mo, hard alloys, and W. On reducing the pressure of the surrounding medium to 10^{-2} torr, layers of much greater thickness (double) were obtained than at atmospheric pressure. There was an optimum pressure for each type of deposited metal. The continuity of the layers improved with increasing degree of vacuum. (Metals Abstr.)

639 METHOD OF PRODUCTION OF AN ALLOY, AND THE ALLOY THEREBY OBTAINED. (to Centre d'Etude de l'Energie Nucleaire). British Patent 1,210,430. 28 Oct 1970. Priority date 24 Jan 1968, Belgium.

A method useful in preparation of austenitic steel, ferritic steel, and Ni-base alloys is described. The powdered alloy constituents are mixed and compressed in a vented metal casing. The metal casing is then sealed and the assembly is subjected to extrusion at elevated temperature after which the outer layer made by the metal casing is removed from the extruded product. The steel produced in this manner is suitable for carbide fuel cladding. (J.R.D.)

640 TECHNICAL SURVEY NO. 2, NUCLEAR FUEL FABRICATION. Nucl. Eng. Int.; 15: 803-17(Oct 1970).

The survey includes three articles which cover the following: consideration of the fuel cycle and a discussion of the problems and alternatives which face the buyer of nuclear fuels; problems encountered in the manufacture of advanced fuels; a description of the new Westinghouse fuel fabrication plant. A pull-out chart provides technical data on the scope and service of the world's fuel fabrication plants. There is also a list of fuel fabricators offering services in other sections of the fuel cycle. (UK)

641 DEVELOPMENT OF FLAT-PLATE FUEL ELEMENTS WITH Al–U (20 PERCENT) AND Al–U(20 PERCENT)–Si(0.8 PERCENT) CORE. Cintra, Sebastiao Hermano Leite; Gentile, Jerto Francisco; Haydt, Heliton Motta; Capocchi, Jose Deodoro Trani (Instituto de Energia Atomica, Sao Paulo, Brazil). Metalurgia (Sao Paulo); 24: 781-7(Oct 1968). (In Spanish).

Experimental studies to obtain fuel elements with a U (20%)–Al alloy for the core clad with Type 1100 or 8001 aluminum alloys were developed. To improve the core plasticity processes such as isothermic treatment of the U–Al alloy; addition of 0.8% Si; and isothermic treatment of the alloy with silicon were studied. Silicon was added to suppress the peritectic transformation UAl_3 to UAl_4, and isothermic treatment was used to effect spheroidizing. The improvement was evaluated by Knoop hardness testing. Alloy ingots were hot rolled from 20 mm to 3.2 mm and the cores were roll bonded in the picture-frame techniques to the final thickness 1.45 ± 0.02 mm. Quality controls from ingot to plate were maintained. Blister, radiographic and metallographic tests provided the good quality of the plate. Better plates were produced from U–Si–Al alloy by subjecting them to isothermic treatment at 600°C. (auth)

642 SECOND EUROPEAN CONFERENCE ON HARD MAGNETIC MATERIALS, MILAN, ITALY, SEPTEMBER 23–25, 1969. IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 149-427(Jun 1970). (CONF-690964).

A separate abstract was prepared for each of six papers presented at the conference. Other papers for which no abstracts were prepared are concerned with the magnetic properties of various compounds and experimental techniques using magnetism. (C.H.)

For abstracts of individual papers see: 574, 594, 643, 676, 1331, and 1332.

643 RECENT DEVELOPMENT OF PERMANENT MAGNET MATERIALS CONTAINING RARE EARTH METALS. Strnat, Karl J. (Univ. of Dayton, Ohio). IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 182-90(Jun 1970).

From 2nd European Conference on Hard Magnetic Materials, Milan, Italy. See CONF-690964.

The prospect that permanent magnets with previously unattainable coercivities and energy products might be made from cobalt–rare earth alloys has caused intense research efforts in the last three years. Alternative ways of preparing magnets from powders and by casting were demonstrated in several laboratories. $(BH)_{max} \approx 20$ MG · Oe and $_MH_c > 25{,}000$ Oe were achieved with $SmCo_5$, and the development of manufacturing processes for magnets made from this alloy has begun. The basic concepts, properties of the alloys of interest, and the physical factors influencing the coercive force are reviewed. Approaches to alloy, powder, and magnet fabrication are discussed, with their merits and drawbacks; also problems incurred in the materials development and their possible solutions. Application areas are reviewed and some economic factors considered. It is concluded that the RCo_5 magnets are indeed beginning to live up to their promise, but that more materials research, process development, and circuit redesign are needed if their potential is to be fully utilized. (auth)

644 WELDABILITY OF ZIRCONIUM WITH NIOBIUM ALLOYS. Novosadov, V. S. Svar. Proizv.; No. 8, 21-3(Aug 1969). (In Russian).

Electron-beam and argon-arc welding were used for tests on the welding of Zr and Nb alloys. Joints of Zr and its alloys (1 to 4% Nb) with Nb and Nb alloys become brittle after a period of time, failure occurring in the weld zone at the Zr side. When making the welded joints, Nb diffuses from the weld into a narrow zone (7 to 10 μm) in the Zr base metal; this zone has a high microhardness. Joint embrittlement is associated with coarse structures and transformations inherent in Zr alloys with Nb contents from 2.5 to 15%. Welding a Zr alloy (with 20 to 25% Nb) with Nb gives quality welded joints which are not susceptible to embrittlement with time. (Metals Abstr.)

Properties Evaluations

Refer also to abstracts 345, 346, 350, 727, 750, 1143, 1307, 1309–1313, 1316, 1318, 1329, 1880, and 1941.

645 (AD-474255) MECHANICAL AND PHYSICAL PROPERTIES OF INVAR AND INVAR-TYPE ALLOYS. McCain, William S.; Maringer, Robert M. (Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center). 31 Aug 1965. Contract AF33(615)-1121. 77p. (DMIC-Memo-207). NTIS.

The mechanical and physical properties of Invar and Invar-type alloys are discussed. Most of these are basically iron–nickel alloys which display unusual temperature dependencies of the thermal expansion and/or thermoelastic coefficients. The compositions and properties of the most useful of these alloys, prin-

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cipally those which exhibit a constant modulus of elasticity or a very low thermal expansion over a significant temperature range are described. Specific alloys discussed are as follows: Invar, Super Invar, Stainless Invar, Elinvar, Ni-Span alloys. Vibralloy, Iso-Elastic, as well as some experimental alloys. (auth) (USGRDR)

646 (AD-476420) HANDBOOK ON THE PROPERTIES OF NIOBIUM, MOLYBDENUM, TANTALUM, TUNGSTEN, AND SOME OF THEIR ALLOYS. Syre, R. (Advisory Group for Aerospace Research and Development, Paris (France)). May 1965. 320p. (AGARDograph-94). NTIS.

Development of materials inherently capable of operating at temperatures above approximately 1000°C for the numerous and critical applications which are found in aerospace equipment and vehicles to an ever increasing degree is described. The materials community in NATO has generally turned to the four refractory metals: niobium, molybdenum, tantalum, and tungsten, and their alloys. Data on physical, mechanical, chemical, and metallurgical properties, and fabrication of these refractory metals and their alloys are presented. (auth) (USGRDR)

647 (AD-487419) REVIEW OF DIMENSIONAL INSTABILITY IN METALS. Maringer, Robert E. (Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center). 23 Jun 1966. Contract AF33(615)-3408. 32p. (DMIC-Memo-213). NTIS.

Problems that arise as a result of dimensional instability are discussed, and data on stability, precision mechanical properties, and stabilization procedures for a variety of materials are presented. Emphasis is placed on the causes and effects of dimensional instability. These are discussed and available information on how they can be controlled is presented. (USGRDR)

648 (AD-487626) PHYSICAL METALLURGY OF BERYLLIUM. Hanes, H. D.; Porembka, S. W.; Melehan, J. B.; Gripshover, P. J. (Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center). 24 Jun 1966. Contract AF33(615)-3408. 45p. (DMIC-230). NTIS.

Recent work done to more fully understand the physical metallurgy of beryllium is summarized. A review of work on purification of beryllium, which has yielded high-quality single crystals, was made. The basic deformation properties of beryllium have thus been more clearly defined. The effects of certain alloying elements and impurities are also discussed. Deformation modes in polycrystalline beryllium are discussed based on the results of studies of single crystals. The texture developed in polycrystalline beryllium by fabrication and resulting effects on mechanical properties are dealt with, as well as fracture modes in single-crystal and polycrystalline beryllium. Bend-plane splitting is the method suggested for initiation of fracture in beryllium. Some effects of the distribution of impurities as a result of thermal treatment on the mechanical properties are cited. Since grain size is an important factor in determining properties, recrystallization and grain-growth phenomena are covered. The physical-metallurgical phenomena which contribute to the properties and fabricability of commercial products are discussed. (auth) (USGRDR)

649 (AWRE-O-49/70) MEASUREMENT OF THE ELASTIC MODULI OF BERYLLIUM BY AN ULTRASONIC RESONANCE TECHNIQUE. Baldwin, M. P. (Atomic Weapons Research Establishment, Aldermaston (England)). Aug 1970. 16p. Dep. NTIS (U. S. Sales Only). UK 2s. 6d. (14p).

Specimens have been prepared from polycrystalline beryllium subjected to various fabrication methods, and measurements made of their elastic moduli over the temperature range 20 to 600°C. The results are discussed and it is concluded that both temperature and fabrication method, with its associated texture, have a marked effect on the elastic moduli. (auth)

650 (CEA-CONF-1635) SOLID STATE PLUTONIUM DIFFUSION. Calais, Daniel; Cornet, Jean-Andre; Cornet, Jean-Francois; Languille, Alain; Remy, Clotilde (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 13p. (In French). (CONF-701001-12). Dep. NTIS (U. S. Sales Only).

From 4th International Conference on Plutonium and Other Actinides, Santa Fe, N. Mex.

The increase in the self-diffusion of body-centered cubic ϵ Pu under a hydrostatic pressure of 0 to 20 kilobars was studied. The activation energy remained a linear function of the melting point. The activation volume for the defects involved in the diffusion mechanism was negative (effect of lattice vacancies negligible). The compressibility χ of plutonium inferred from the measurement of Young modulus and Poisson coefficient by the ultrasonic resonance method was very large ($\chi = 17.10^{-11}$ m^2/N at 500°C). The elastic theory would accommodate an appreciable relaxation of the vacancies with low but positive activation volumes. The contraction of Pu on melting is explained by a change in the electronic structure of the atom, a valency close to 7 being obtained for liquid Pu whereas it is only 5 in the ϵ phase. From the energy point of view, the results obtained can be interpreted in elastic theory by a mechanism of diffusion by interstitials, the migration of the interstitial taking place by an indirect process. A Kirkendall effect was found for the Pu-Zr system in the $\epsilon\beta$ phase. The variation in the intrinsic diffusion coefficients and the flux of the two species was studied as a function of concentration. Plutonium diffused the most rapidly. In dilute Ti-Pu, Zr-Pu, Ti-U alloys an accelerated diffusion of the solute atoms during the martensitic type $\beta \rightarrow \alpha$ phase change was also observed. After annealing and tempering a macroscopic and anisotropic migration of the solute atoms took place. (France)

651 (CONF-700819-4) SOLID SOLUTION WEAKENING OF BCC SOLID SOLUTIONS. Hasson, D. F.; Arsenault, R. J. (Maryland Univ., College Park). 1970. Contract AT(40-1)-3612. 11p. Dep. NTIS.

From 2nd International Conference on the Strength of Metals and Alloys, Pacific Grove, Calif.

In order to determine if the mechanism of solid solution weakening in scavenging or reduction of Peirls' stress, an internal friction study was made on Ta-2 at.% W, Ta-9.2 at.% Nb, and V-1.31% Ti alloys containing oxygen interstitials. The results show no scavenging in the first two alloys, while Ti scavenges the oxygen interstitials in V. (D.L.C.)

652 (N-70-30113) SURVEY OF PROPERTIES OF T-111 (TANTALUM-8 TUNGSTEN-2 HAFNIUM). Moorhead, Paul E.; Stone, Phillip L. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Jun 1970. 26p. (NASA-TN-D-5873; E-5562). NTIS.

A survey of available information concerning T-111 alloy is presented. This includes thermophysical properties, mechanical properties, melting and fabrication, welding, and resistance to alkali-metal corrosion. T-111 is shown to be a suitable engineering material for advanced space power systems. (auth) (STAR)

653 (NP-18486) THERMOTRANSPORT OF OXYGEN AND NITROGEN IN β-ZIRCONIUM, β-TITANIUM, NIOBIUM, AND TANTALUM. Vogel, Daniel Lodewijk (Technische Hogeschool, Eindhoven (Netherlands)). 1969. 164p. Dep. NTIS (U.S. Sales Only).

Thesis.

The phenomenon of thermotransport (i.e., migration of atoms under the influence of a temperature gradient) in solid interstitial alloys was investigated. Single-phase alloys of oxygen and nitrogen in metals of groups IV A and V A were used. The results of the thermotransport experiments, and of some minor experiments related to the subject, are presented. Their reliability was discussed based on computer calculations and the data presented. The heat of transport of oxygen in β-zirconium was found to be 21.3 kcal/mole with a standard deviation of 2.9 kcal/mole, and that of nitrogen 25.1 kcal/mole with a standard deviation of 2.5 kcal/mole. The study of thermotransport of oxygen and nitrogen in titanium, niobium, and tantalum is complicated by evaporation processes. Oxygen and nitrogen in β-titanium were found to have a positive heat of transport. Results gave a strong indication that the heat of transport of oxygen in α-titanium is negative. The heat of transport of oxygen, and probably also that of nitrogen, in niobium is very low. The heat of transport of oxygen in tantalum was found to be negative: an estimate yielded a value of approximately -10 kcal/mole. (J.R.D.)

654 (WARD-4135-12) STAINLESS STEEL CLADDING DEVELOPMENT. Quarterly Progress Report for the Period Ending June 30, 1970. Ray, William E. (Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.). Aug 1970. Contract AT(30-1)-4135. 49p. Dep. NTIS.

In work devoted to evaluation of austenitic stainless steel microcharacterization and mechanical property testing, including biaxial tensile, biaxial stress rupture, and both uniaxial and biaxial creep were continued on ARD vacuum melted materials. Comprehensive characterization, including texture evaluation, was completed for two lots of planetary swaged tubing and the results were compared with plug drawn material. Biaxial tensile testing at room temperature and five elevated temperatures was completed on four tubing lots, completing the biaxial tensile testing planned for the vacuum melted steels program. Results were compared for the evaluation of the effects of the independent variables on the properties of tubing. Thirty-eight stress rupture tests were completed, and longer term tests are continuing. The results from seven lots of material representing various combinations of the

independent variables were compared. Classification of the mode of rupture of post-test biaxial stress rupture specimens continued. Strain measurements of fifteen specimens were completed and results compared. Metallographic examination of selected specimens from this group is planned. A shipment of 500 feet of Battelle–Northwest (BNW), double vacuum melted, Type 316 stainless steel tubing has been received for use in the Oxide Fuel Element Development Program. (auth)

655 DETERMINATION OF CADMIUM ACTIVITY IN Cd–Zn ALLOY BY THE TORSION EFFUSION METHOD. Piacente, Vincenzo; Lepore, Luca; Desideri, Alessandro; de Ceglie, Enzo (Univ., Rome). Ric. Sci.; 39: 868-73(Oct-Dec 1969). (In Italian).

The total vapor pressure over Cd–Zn alloys was measured by the torsion effusion method. The chemical activities of cadmium at 660°K in alloys of different composition were computed. These activities exhibited fairly large positive deviations from Raoult's throughout the entire compositional range. Literature data are compared. (auth)

656 EFFECT OF HYDROSTATIC PRESSURE ON ALUMINUM AND BERYLLIUM SELF-DIFFUSION. Beyeler, M. (CEN de Saclay, Gif-sur-Yvette, France); Lazarus, D. Mem. Sci. Rev. Met.; 67: 395-400(Jun 1970). (In French).

Aluminum and beryllium self-diffusion at pressures between 0 and 8 kilobars, at 693°C in the case of Be and in a temperature range 400 to 610°C in the case of Al, was studied. Experimental results on diffusion coefficients and activation energy revealed the effect of high pressures. Activation volumes could be deduced from these results. (auth) (France)

657 EFFECT OF ADDITIONAL ELEMENTS ON INTERNAL FRICTION OF NEUTRON IRRADIATED ALUMINUM AT 78°K. Grynszpan, Robert; Dimitrov, Colette; Dimitrov, Omourtague (Centre National de la Recherche Scientifique, Vitry-sur-Seine, France). Compt. Rend., Ser. C; 271: 261-4(27 Jul 1970). (In French).

Addition of copper or silver at a concentration of 100×10^{-6} in neutron irradiated aluminum at 78°K induces specific peaks of internal friction for any alloy element. These peaks are most probably due to the presence of point defect-impurity complexes. (auth) (France)

658 ESTIMATION OF THE ACTIVATION ENERGIES FOR INTERGRANULAR DIFFUSION OF URANIUM IN THE HYPERSTOICHIOMETRIC DIOXIDE UO_{2+x}. Marin, J. F. (Centre d'Etudes Nucleaires, Grenoble, France). J. Nucl. Mater.; 34: 348-50(Mar 1970). (In French).

The Suzuoka method for the calculation of the intergranular diffusion coefficients for thin films deposited in limited quantity was applied to the portions of the α spectrum profiles corresponding to deep zones ($5\ \mu m \lesssim z \lesssim 10\ \mu m$) where the intergranular diffusion is preponderant. The assumptions made for this application of the method are given. The calculations were made for $x = 0.045$ and $x = 0.10$ and the diffusion coefficients obtained were 46 ± 17 and 68 ± 11 kcal/mole, respectively. The intergranular diffusion activation energies were much less than those of volume diffusion. (J.S.R.)

659 RARE-EARTH METALS. Taylor, K. N. R. (Univ. of Durham, Eng.). Contemp. Phys.; 11: 423-54(Sep 1970).

A brief survey is given of the physical properties of the rare earth metals. Their characteristic structural and magnetic behavior is described first and then the ways in which these features affect the other properties are examined. (auth) (UK)

660 STRUCTURAL HARDENING OF SOME COPPER ALLOYS. Schoofs, J. Rame; 7: No. 27, 50-8(Sep 1969). (In Italian).

The age-hardening Cu-base alloys are considered and the properties and applications of Cu–Cr and Cu–Be are described. Some less well known alloys are considered and details are given of the aging properties of Cu alloys containing Co 2%, Co 2%–Si 0.5%, Al 6%–Co 1.37%, Al 6.9%–Ni 5%–Co 1.7%, Ni 1.1%–P 0.22%, or Ag 6%. (Metals Abstr.)

661 THERMODYNAMICS OF METAL-INTERSTITIAL SOLUTIONS. Gallagher, P. T. (Newcastle Univ., Australia). Australas. Inst. Mining Met. Proc.; No. 235, 77-85(Sep 1970).

Thermodynamic analysis of the infinitely dilute solution of hydrogen in metals indicated a correlation between the partial excess entropy and the partial heat of solution of H in the metals. Vibrational factors were interpreted as contributing most to ΔS_H^{xs}. A marked difference in vibrational frequency for H was observed between body-centered cubic and close packed lattices. Monte Carlo methods were used to compute the arrangements of C atoms dissolved in austenite and of H atoms dissolved in Zr, V, Nb, and Ta, using the blocking concept. Agreement between calculated and experimental entropies was the closest yet obtained. Available data on the inelastic scattering of cold neutrons by metal hydrides and the isotopic solubility method were used to provide some information on the dissolved H. Measurements of the isotopic solubility ratio at constant temperature for Pd–H are discussed. (Australia)

662 STUDY OF SINTERED METAL MATERIALS MANUFACTURED ON THE BASE OF TUNGSTEN, MOLYBDENUM, AND SILVER. Lambijew, D. K.; Todorow, R. P. Elektronika; No. 3, 127-31(1970). (In Polish).

The scientific and technological research work concerning the powder metallurgy of tungsten, molybdenum, and silver in Bulgaria is summarized. The great improvements which have been made in recent years in the production of pseudo-alloys allow the development of new methods of pressing, sintering, and calibration; this improvement makes possible the application of the pseudo-alloys as contact materials in electronic and electric equipment. (auth)

663 COMPARISON OF HIGH ENERGY RADIOGRAPHIC TECHNIQUES FOR LARGE DIAMETER TITANIUM BILLETS. Sattler, F. J. (Thompson Ramo Wooldridge Inc., Cleveland). Non-Destruct. Test.; 3: 357-62(Oct 1970).

The defect resolution capabilities of a 25 MeV betatron and a 7.5 MeV linear accelerator for the nondestructive testing of large diameter titanium billets are compared. The effects of lead front and back screen thicknesses, exposure geometry and film variables on the quality of the radiographic image are described. The applicability of each unit is discussed in view of the resolution achieved and the economics of the radiographic procedures. (auth) (UK)

664 ZIRCALOY CLADDING TUBES FOR NUCLEAR FUEL. Nagai, Nobuyuki; Kakuma, Tutomu (Kobe Steel, Ltd., Japan). Sosei To Kako; 11: 213-22(Mar 1970). (In Japanese).

The Zircaloy cladding tubes for nuclear fuel in power-generating, light-water cooled reactors are described. The past development, the method of production, and inspection are reported. The cladding material for nuclear fuel such as beryllium, magnesium, aluminum, stainless steel, and zirconium are compared. The development of Zircaloy-1, -2, -3, and -4, are reviewed. The production procedure of Zircaloy cladding tubes, including the production of zirconium sponge, ingot, and billet, and extrusion and heat treatment are described. The inspection of products for dimension, defect, mechanical property, microstructure, and corrosion is summarized. The change in the quality of cladding tubes with the production condition is examined. Elastic anisotropy and the directional precipitation of hydrides are dealt with. (Japan)

665 MATERIAL PROBLEMS FOR THE CONSTRUCTION AND SAFETY EVALUATION OF REACTOR PRESSURE VESSELS. Maurer, H. A. (European Atomic Energy Community, Brussels). Tech. Ueberwach.; 11: 197-200(1970). (In German).

A review is presented of the problems that occur during fabrication and welding of heavy-wall pressure vessels consisting of low-alloy steels, carbon steels, and stainless steels. Methods for protection of the material against corrosion, hydrogen embrittlement, and radiation effects during operation, are discussed. Methods for the analysis of material failures are represented, e.g., fracture-toughness hypothesis, viscous flow under plasticity conditions with crack expansion, fracture mechanics, brittle fracture diagrams, and cyclic crack growth. Test programs of stress cycle and creep behavior and crack behavior are considered. The inspection techniques for the early perception of material failures are briefly given. (INIS)

666 EFFECT OF MOLYBDENUM AND TUNGSTEN ON THE PROPERTIES OF HARD-FACING METAL ON ALLOYING THROUGH THE COATING. Sorokin, L. I.; Erokhin, A. A. Svar. Proizv.; No. 12, 8-11(Dec 1969). (In Russian).

The effect of Mo and W on the mechanical properties of Ni–Cr hard-facing metal was studied. The best combination of strength and ductility was achieved by the addition of Mo 22 or W 4 to 5%, the former of these proving most satisfactory under practical conditions. Even better results were obtained by alloying with Mo and W simultaneously, the relative proportions of these being adjusted in accordance with the particular combination of properties required. The maximum UTS at 20°C achieved in this way was 70 kg/mm². (Metals Abstr.)

667 NIOBIUM IN SHEET AND FOIL FORM: PROPERTIES AND PROCESSING. Meckelburg, Ernst. Blech; 16: 594; 596; 598-9(Oct 1969). (In German).

The properties of Nb, including chemical stability, corrosion resistance to various acids and alkalis, physical and mechanical

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properties, machinability, and the welding characteristics of Nb sheet and foil are tabulated and described. (Metals Abstr.)

668 ROLE OF THORIUM IN POWER-REACTOR DEVELOPMENT. Kasten, P. R. (Oak Ridge National Lab., Tenn. Univ. of Tennessee, Knoxville). At. Energy Rev.; 8: 473-534(Sep 1970).

The basic role of thorium fuel cycles in power-reactor development will be determined by their ability to generate, in economic reactor types, lower cost nuclear power than that generated by use of uranium cycles. The primary advantages of the thorium cycle are associated with the relatively high η for ^{233}U in thermal reactors, and the relatively constant effective η of thorium-based fuel as the neutron-energy spectrum changes in fast reactors. The primary disadvantages of the thorium cycle are associated with the relatively high unit cost of fissile fuel in thermal reactors, and with the relatively low η-value in fast reactors. Some physical property advantages are associated with thorium — relative to uranium-based fuels, which tend to increase the application of the thorium cycle; at the same time, for early economic application in thermal reactors, thorium cycles are generally more dependent than uranium cycles upon a technology which permits fuels to be fabricated, moved, and processed inexpensively. Reactors considered here include light-water reactors (LWR), heavy-water reactors (HWR), gas-cooled graphite-moderated reactors, molten-salt graphite-moderated reactors, and sodium-cooled fast reactors. For the reference evaluation conditions (associated with 1000-MW(e) reactors, a large central-station processing-and-fabrication plant, and private reactor ownership), use of the thorium cycle appears economically preferable over the uranium cycle in high-temperature gas-cooled reactors (HTGR) and in molten-salt reactors (MSR). Relative to fast reactors, use of mixed uranium-thorium fuel cycles rather than the uranium cycle alone appears to improve reactor safety characteristics while still retaining good fuel utilization and economic characteristics. Use of the thorium cycle appears more economical in pressurized water reactors than in boiling water reactors, but at present this cycle does not appear to have power cost advantages over the first uranium cycle in either concept. However, if LWRs recycle fuel and/or if fissile plutonium were available at about $5/g, the thorium cycle would be preferable. Similar statements appear applicable to pressure-vessel HWRs. Pressure-tube HWRs operate most economically on the first uranium fuel cycle; however, mixed uranium–thorium cycles appear more promising than the thorium cycle alone. In general, thorium fuel cycles will have increasing importance as MSR and HTGR reactor types become a part of the commercial power market, as more emphasis is placed on obtaining a negative void coefficient in sodium-cooled fast reactors, and/or as fuel recycle becomes economically important in water reactors. For breeder operation, thorium-fueled molten-salt reactors and fast reactors employing a uranium–thorium mixed cycle appear to have high application potential. (auth)

669 METHOD OF STUDYING THE ELASTIC PROPERTIES AND INTERNAL FRICTION OF MATERIALS WITH A CONTINUOUS TEMPERATURE VARIATION. Voitenko, A. F.; Novikov, N. V. Probl. Prochnosti; 1: No. 5, 25-6(Nov 1969). (In Russian).

An improved form of apparatus for studying the internal friction and elastic properties of metals and other materials subjected to a continuous change of temperature is described. The apparatus incorporates an automatic recorder in which the horizontal motion is proportional to the temperature of the sample and the vertical motion to the amplitude of vibrations. This system has the advantage of recording resonance frequencies very accurately; as the temperature varies, the error in determining the relative changes in elastic constants is no greater than 0.1%. Examples are given for Nb and for C steel. (Metals Abstr.)

670 MECHANICAL PROPERTIES AND DEFORMATION CHARACTERISTICS OF NICKEL AND TITANIUM REINFORCED WITH TUNGSTEN WIRE. Ivanova, V. S.; Kopetsky, Ch. V.; Markov, A. M.; Orzhekhovskii, V. L. Probl. Prochnosti; 1: No. 2, 35-40(Aug 1969). (In Russian).

The properties of Ni and Ti reinforced with W wire were investigated. Technically-pure Ni and Ti alloy VTZ-1 were reinforced with single, unbroken W wires 1.5 mm in dia. The composite was obtained by rolling in vacuum at 1000°C, i.e., lower than the recrystallization temperature of W, the surfaces of the wire and matrix being chemically etched before rolling. Tensile strength and elongation of the composites were measured at 20 to 800°C, and for various compositions up to ~50% W. If the reinforcing wire in its initial condition had some plasticity, the matrix showed some increase in strength and plasticity. If the reinforcing wire was initially brittle, then this was reflected in the properties of the composite and fragmentation of the wires occurred. (Metals Abstr.)

671 INTERPRETATION OF MICROFLOW MEASUREMENTS IN NIOBIUM CRYSTALS. Wilson, F. Graham; Teghtsoonian, E. (Univ. of British Columbia, Vancouver). Phil. Mag.; 22: 815-31(Oct 1970).

The application of the microstrain technique to bcc metal deformation is discussed and an interpretation of microflow data given with reference to experiments on pure Nb single crystals deformed in tension. Microflow in prestrained crystals is explained in terms of a transition from edge dislocation motion to screw dislocation motion at the macroflow stress. Interstitial effects are found to be particularly significant during microflow and are probably important in determining the low temperature flow stress in even the highest purity bcc metals. A further low temperature contribution comes from a directional component of the internal stress field which depends on the distribution of dislocations rather than on their density. (auth) (UK)

672 TEMPERATURE DEPENDENCE OF THE MODULUS OF NORMAL ELASTICITY OF NIOBIUM AND ITS ALLOYS. Nadezhdin, G. N.; Malashenko, I. S.; Kuporev, A. L. Probl. Prochnosti; 1: No. 4, 67-71(Oct 1969). (In Russian).

Reasons for the peculiar form of the elastic modulus/temperature curves of Nb and its alloys are discussed. For Nb the modulus falls with increasing temperature to 400 and then rises sharply up to 1200°C. The extent of these effects is considerably altered on introducing 1 to 5% of Mo, C, or Zr. The form of the elastic modulus/temperature curves is partly attributed to the development of texture (as a result of preliminary working) and the presence of internal stresses. The effect of alloying with Mo or Zr is attributed to changes introduced in the solubility of oxide and nitride impurities in the parent metal. (Metals Abstr.)

673 EFFECT OF CARBON [AND ZIRCONIUM] ON THE ELASTICITY AND LONG-TERM HARDNESS OF NIOBIUM AT HIGH TEMPERATURES. Nadezhdin, G. N.; Malashenko, I. S. Probl. Prochnosti; 1: No. 2, 83-5(Aug 1969). (In Russian).

Experimental data on the effect on properties of alloying Nb with small quantities of C and Zr are presented. Tests were carried out on the binary alloy Nb–0.1% C, the preparation of which is given in detail. Alloys containing Zr (Nb–1.63% Zr–0.08% C and Nb–2.6% Zr–0.08% C) were also tested. Test temperatures were from 23 to 1400°C. Curves are given showing the effect of temperature on the modulus of elasticity, and the effect of temperature and time on hardness. At 23°C carbon strengthens Nb but above 1000°C, it has a weakening effect. The introduction of Zr into the Nb–C alloy displaces the weakening effect into a zone of higher temperature. (Metals Abstr.)

674 APPLICATION OF THE MOIRE TECHNIQUE TO FRACTURE-TOUGHNESS TESTS ON ZIRCONIUM ALLOYS. Luxmoore, A. (Univ. of Wales, Swansea); Wyatt, P. J. J. Strain Anal.; 5: 302-8(Oct 1970).

A description is given of some initial experiments carried out on zirconium notched bend specimens, to determine the feasibility of using the Moiré technique to measure crack opening displacements smaller than 0.001 in. and areas of plastic flow immediately beneath the notch. (auth) (UK)

675 ELASTIC CONSTANTS OF SINGLE-CRYSTAL AND POLYCRYSTAL CADMIUM–MAGNESIUM ALLOYS. Maennel, P.; Guenther, F. (Bergakademie, Freiberg i B.). Phys. Status Solidi (a); 3: 137-41(16 Sep 1970).

For disordered cadmium–magnesium alloys containing up to 14 at.% Mg, the elastic parameters of polycrystals and single crystals at room temperature are reported. The moduli E and G as well as the constants C_{ij} of the single crystals show a marked decrease with increasing magnesium content. The connection between texture and modulus E of polycrystals is pointed out. (auth)

676 RELATIONS BETWEEN STRUCTURE AND PROPERTIES IN MAGNETICALLY HARD Fe–Co–V ALLOYS: DEFICIENCIES OF EQUILIBRIUM DIAGRAMS. Josso, Emile (Centre de Recherches, Imphy, France). IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 230-2(Jun 1970).

From 2nd European Conference on Hard Magnetic Materials, Milan, Italy. See CONF-690964.

New findings concerning the reactions between phases in the Fe–Co–V system provided a possible explanation for several anomalies observed in the variation of saturation induction and resistivity during annealing. This explanation is based on the fact that saturation induction is related to the respective proportions of magnetic ($\alpha + \alpha'$) and nonmagnetic (γ) phases, while resistivity depends also on the relative amounts of ordered (α') and disordered (α) phases. By comparison with the saturation induction and the resistivity, it was shown that the coercive force of Fe–Co–V alloys containing 52% Co and 3.5 to 8% V, initially

disordered by heavy cold-working, then annealed in the range 550 to 600°C, seemed to depend primarily on the amount of γ phase precipitated in the magnetic matrix, while the retentivity appeared to be governed essentially by the degree of ordering in this matrix. (auth)

677 RELATION BETWEEN THE SWELLING OF METALLIC FUELS AND THE RELEASE OF FISSION GASES. Kryger, Bernard; Mikailoff, Hubert (CEN, Fontenay-aux-Roses, France). J. Nucl. Mater.: 34: 234-6(Feb 1970). (In French).

Canned annular cylinders of unalloyed U and U – 8% Mo were irradiated in order to observe under what conditions a central hole can be used to permit the release of the fission gases by a free but limited swelling of the fuel. The cans were stainless steel, 0.40 mm in thickness. Three diameters of the central holes, representing 19%, 25%, and 33% of free swelling, were used. After irradiation to a high burnup of the order of 35,000 Mwd/t, it was established that the claddings of uranium with 19 and 25% initial vacuum were ruptured. One of the 33% samples had a small local fissure. The canned U – Mo alloys underwent a deformation, whose value was connected to the dimensions of the initial central hole. All the central holes were filled up and a porosity distributed homogeneously in the section was formed. Anneals made on uncanned U – Mo alloys showed that the gas release follows a fast kinetics above 600°C. The shape of the release curve was not affected by the initial value of the swelling. (J.S.R.)

678 TERMOPROCHNOST' MATERIALOV I KONSTRUKTIVNYKH ELEMENTOV. VYPUSK 5. (Thermal Stability of Materials and Structural Element. Issue 5). Pisarenko, G. S. (ed.). Kiev; Izdatel'stvo Naukova Dumka (1969). 512p.

Information is presented on the strength of machine parts and installations followed by data and information concerned with the thermal resistance of refractory materials, carbides, fiberglass, and other brittle materials. New experiments and methods for testing materials at high and low temperatures are summarized. Creep and life span of materials in reactor irradiation fields, temperature resistance of refractory metals and alloys at 2000°K, and instrumentation for programming and control of rates of metal deformation and fatigue are discussed. Mechanical properties of metals at low temperatures in a vacuum and their resistance to high shock rates at +20°C to –196°C are reviewed. (R.V.J.)

679 RECENT APPLICATIONS OF THE RARE EARTH METALS IN NONFERROUS METALLURGY. Hirschhorn, I. S. (Ronson Metals Corp., Newark, N. J.). J. Metals; 22: No. 10, 40-3(Oct 1970).

The use of rare earth additions to improve the electric and anticorrosion properties of superalloys and nonferrous alloys such as Mg-base, Al-base, and Cu-base systems is reviewed. (J.R.D.)

680 ELECTROCAPILLARY PROPERTIES OF A GALLIUM–INDIUM ALLOY. Polyanovskaya, N. S.; Frumkin, A. N. Elektrokhimiya; 6: 246-9(Feb 1970). (In Russian).

As a continuation of an earlier investigation into the electrocapillary behavior of binary systems containing Ga (Elektrokhimiya, 3: 1129(1967)), the electrocapillary characteristics of a Ga–In alloy of eutectic composition (16.7 at. % In, mp 15.73°C) were studied. On adding In to Ga the maximum surface tension of the latter fell sharply, approaching that of pure In on reaching the eutectic composition. This indicated that the In had a substantial surface activity with respect to Ga and that the surface layer tended to assume a state of In saturation. (Metals Abstr.)

Structure and Phase Studies

Refer also to abstracts 767, 1308, 1314, 1315, 1331, and 1332.

681 (CEA-CONF–1631) STUDY OF THE PLUTONIUM–SCANDIUM SYSTEM (DIAGRAM AND PROPERTIES). Ballagny, Alain; Boucher, Rene; Carrard, Claude (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 11p. (In French). (CONF-701001–10). Dep. NTIS (U. S. Sales Only).

From 4th International Conference on Plutonium and Other Actinides, Santa Fe, N. Mex.

The plutonium-scandium phase diagram was established. This structural determination was based on a study by x ray diffraction, metallography, dilatometry, and density measurements. The limits of the delta region at room temperature lie between 4.0 and about 20 at.% of scandium. The maximum solubility of scandium in the delta phase at 658°C is about 28 at.%. The temperature of the peritectoid transformation (delta → epsilon + zeta) was found to be 658° ± 3°C, and that of the second peritectoid transformation (zeta → epsilon + alpha (scandium)) was 745 ± 3°C. Properties such as crystal parameters, densities, thermal expansion coefficients, electrical resistivity, resistance to atmospheric oxidation between 20 and 400°C, hardness, and rolling capacity were examined. Tables are given of values relative to the following compositions: 3, 8, 10, 14, 17, 25, 50 and 70 at.% of scandium. Results of a more limited study on the properties of alloys containing between 70 and 100 at.% of scandium are included. (auth) (France)

682 (CONF-700403–(Vol.1)) PROCEEDINGS OF THE 8th RARE EARTH RESEARCH CONFERENCE, RENO, NEVADA, APRIL 19–22, 1970. VOLUME I. SESSIONS A THROUGH H. Henrie, Thomas A.; Lindstrom, R. E. (eds.) (Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center). 475p.

A total of 41 papers and 5 abstracts is included in Vol. I. A separate abstract was prepared for each of 29 papers. The remaining 12 papers were not within the scope of NSA. (G.M.C.)

For abstracts of individual papers see: 65–68, 115, 200–202, 722, 742–744, 764–767, and 1307–1319.

683 (CONF-700403–(Vol.2)) PROCEEDINGS OF THE 8th RARE EARTH RESEARCH CONFERENCE, RENO, NEVADA, APRIL 19–22, 1970. VOLUME II. SESSIONS I THROUGH M. Henrie, Thomas A.; Lindstrom, R. E. (eds.) (Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center). 384p.

A total of 33 papers and 13 abstracts is included in Vol. II. A separate abstract was prepared for each of 15 papers. The remaining 18 papers were not within the scope of NSA. (G.M.C.)

For abstracts of individual papers see: 5, 69, 116, 203–207, 629, 630, 684–687, and 723.

684 (CONF-700403–(Vol.2), pp 524-31) PHASE DIAGRAMS FOR THE Ce–Co, Pr–Co, AND Nd–Co ALLOY SYSTEMS. Ray, Alden E. (Dayton Univ., Ohio. Research Inst.); Hoffer, Gary I. (Air Force Materials Lab., Wright-Patterson AFB, Ohio).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

Phase diagrams are proposed for the cerium-cobalt and praseodymium-cobalt alloy systems between and 50 and 100 at. % Co and the neodymium-cobalt over the total range of compositions. The cobalt-rich portions of each system contain five intermediate phases corresponding to RCo_2, RCo_3, R_2Co_7, RCo_5, and R_2Co_{17} stoichiometry. All of these phases form by peritectic reaction. The neodymium-rich half of the Nd-Co system contains at least two additional phases, Nd_3Co which melts congruently and Nd_2Co which forms by peritectic reaction between 27 and 31 at. % Co. (auth)

685 (CONF-700403–(Vol.2), pp 570-81) EFFECT OF THE SIXTH-PERIOD ELEMENTS ON THE MELTING AND TRANSFORMATION TEMPERATURES OF PRASEODYMIUM. Griffin, R. B.; Gschneidner, K. A. Jr. (Iowa State Univ. of Science and Technology, Ames).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

A systematic study of the alloying behavior of the praseodymium-rich alloys with the sixth period elements, Cs, Ba, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, and Bi was carried out by employing metallographic, thermal analysis, x-ray, and chemical analysis techniques. (auth)

686 (CONF-700403–(Vol.2), pp 598-609) CORRELATIONS BETWEEN SYSTEMS OF YTTRIUM WITH THE GROUPS IVB AND VB ELEMENTS. Carlson, O. N.; McMasters, O. D.; Schmidt, F. A. (Ames Lab., Iowa).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

Correlations between the systems of the Y-Group IVB and Y-Group VB elements are given with emphasis on the structural relationships between compounds and their properties. A phase diagram is proposed for the Y-Sb system. There are three peritectic compounds, Y_3Sb, Y_5Sb_3, and Y_4Sb_3, and one congruently melting phase, YSb, in the system. Preliminary thermal analysis data are also presented on the Y-Ge system. (auth)

687 (CONF-700403–(Vol.2), pp 664-72) AN ELEVATED TEMPERATURE X-RAY DIFFRACTION AND AN ELECTRON MICROSCOPY STUDY OF THE TRANSFORMATIONS TO THE SAMARIUM-TYPE STRUCTURE IN GADOLINIUM–CERIUM ALLOYS. Koch, C. C.; Mardon, P. G.; McHargue, C. J. (Oak Ridge National Lab., Tenn.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

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Further results of a study of the phase transformations to the Sm-type structure in Gd-Ce alloys are presented. More complete data of the critical temperatures determined by electrical resistance measurements are given. Elevated-temperature x-ray diffraction experiments established the higher temperature set of critical temperatures as the structural change to and from the Sm-type phase while the lower critical temperatures coincided with a discontinuous dimensional change in the Sm-type unit cell. Transmission electron microscopy revealed a heavily faulted structure with the presence of twins, dislocation loops, and nonmetallic second phase precipitate particles. (auth)

688 (COO-1700-11) NUCLEAR MAGNETIC RESONANCE STUDY OF THE CRYSTALLINE PHASES OF NbN_x AND $NbBe_x$ AND SUPPLEMENT ON ACOUSTIC NUCLEAR MAGNETIC RESONANCE. Bennett, Robert A. (Wayne State Univ., Detroit, Mich.). 1969. Contract AT(11-1)-1700. 94p. Dep. NTIS.

Thesis.

Nuclear magnetic resonance was employed to study the structure of several samples of the system NbN_x where the mole fraction of nitrogen varied from 0.884 to 0.95. The samples of NbN_x were in the form of powders. In the preparation of the various phases of NbN_x, niobium or niobium hydride powder was heated in flowing nitrogen to the temperature (above 1200°C) at which the solid phases of NbN_x are formed. The samples were rapidly cooled in a water-cooled chamber. In such a manner crystalline phases of NbN_x which were formed and which were stable at high temperatures were quenched to room temperature where the crystalline phases are essentially stable. The powder samples used in the NMR investigations were examined at room temperature unless otherwise stated. The intermetallic compounds of the system, $NbBe_x$, were investigated because these materials are stable, have high strength, strength retention at elevated temperatures, and thermal-shock resistance. The compounds $NbBe_2$, $NbBe_3$, Nb_2Be_{17} and $NbBe_{12}$ were investigated. X-ray analysis was performed and the results are given. Because of the similarity in the NMR of the ^9Be nucleus in the above mentioned compounds, these results are discussed jointly. The ^{93}Nb nucleus, however, exhibits a vastly different NMR for each compound and thus each compound is considered separately. Results of acoustic magnetic resonance studies are reported in which the small absorption of acoustic power was observed by coupling a transducer to the conventional Pound-Watkins type oscillator (Pound box). The coupling was accomplished by a matching network which matched the impedance of the transducer to a value that would allow the oscillator to oscillate and still remain sensitive. The sample was a KI single crystal in the shape of a cylinder $\frac{1}{2}$ inch in diameter and $\frac{5}{8}$ inch long. The sample was acoustically bonded to a $\frac{1}{4}$ inch diameter X-cut quartz transducer to form a composite acoustic cavity. In this acoustic cavity standing waves were established at specific resonance frequencies. (J.R.D.)

689 STUDY OF THE MECHANICAL PROPERTIES OF Zr-Nb ALLOYS. Quivy, Annick; Guerillon, Jean-Pierre; Lehr, Pierre (Centre National de la Recherche Scientifique, Vitry-sur-Seine, France). Compt. Rend., Ser. C; 271: 269-72(27 Jul 1970). (In French).

Quenched Zr-Nb alloys are characterized by a high tensile strength due to the martensitic decomposition of the beta phase for the alloys with small Nb contents (less than 7% Nb) or due to the appearance of metastable hardener phases, ω or x in alloys (7 to 20% Nb) enriched in Nb. (auth) (France)

690 INTERACTIONS IN THE GOLD-CADMIUM-MERCURY SYSTEM. Kozin, L. F.; Cherkasova, G. F.; Erdenbaeva, M. I. Izv. Akad. Nauk Kaz. SSR, Ser. Khim.; No. 3, 42-9(1969). (In Russian).

Two intermetallic compounds of composition Au_3Cd and AuCd in the Au-Cd-Hg system. Equilibrium in this system is characterized by a solubility product for Au_3Cd of 4.2×10^{-17} and for AuCd of 4.9×10^{-9}. Thermodynamic data were calculated for these compounds in the Hg phase: $\Delta H_{Au_3Cd} = -20.8$, $\Delta H_{AuCd} = -12.0$ kcal/mole, $\Delta G_{Au_3Cd} = -22.43 \pm 0.10$, $\Delta G_{AuCd} = -11.55 \pm 0.14$ kcal/mole, and $\Delta S_{Au_3Cd} = +5.4$, and $\Delta S_{AuCd} = -1.5$ cal/mole-degree. (Referativnyi Zh.)

691 METALLOGRAPHIC STUDY OF THE CELLULAR SUBSTRUCTURE IN MELT-GROWN CADMIUM SINGLE CRYSTALS. Thattey, A. S. (Indian Inst. of Tech., Bombay). Indian J. Technol.; 6: 164-6(Jun 1968).

The interface structures of cadmium single crystals prepared from molten state by Bridgman's technique have been subjected to metallographic examination with the object of studying the effect of the presence of soluble impurities in the melt on the cellular structure. The addition of zinc to the melt to the extent of 0.05 percent (by weight) leads to the formation of dendritic structure, which has been attributed to supercooling of the melt by zinc and the consequential total suppression of cellular structure. (auth)

692 CRYSTALLOGRAPHIC PROCEDURES FOR THE ELECTRON MICROSCOPY OF HEXAGONAL METALS. Bedford, A. J.; Miller, D. R. (Univ. o Adelaide). J. Aust. Inst. Metals; 15: 179-84(Aug 1970).

Procedures for solving crystallographic problems arising during the electron microscopy of zirconium are discussed. The use of Miller indices for planes and directions in both real and reciprocal space is advocated. A Kikuchi map covering a large range of orientations was constructed for an hexagonal lattice with c/a = 1.59. The use of this map, in conjunction with a series of standard diffraction patterns, for the rapid determination of Burgers vectors of dislocations is described. (auth) (Australia)

693 CRYSTAL STRUCTURE OF RARE-EARTH-NICKEL COMPOUNDS OF THE TYPE R_2Ni_7. Buschow, K. H. J.; Van Der Goot, A. S. (Philips Research Labs., Eindhoven, Netherlands). J. Less-Common Metals; 22: 419-28(Dec 1970).

Various rare-earth-nickel alloys with 70 to 80 at. % Ni were studied by x-ray diffraction and metallography. The lattice parameters of compounds of the type RNi_3 and R_2Ni_7 have been determined for R = La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, and Y. A structure determination is given for La_2Ni_7 and Sm_2Ni_7. Some of the compounds R_2Ni_7 have been observed to have two modifications. Indications have been obtained that the transformation between these two modifications is of the martensitic type. It is shown that the crystal structure of the R_2Ni_7 compounds is size-dependent. (auth)

694 STUDY OF VACANCIES IN TUNGSTEN WIRES QUENCHED IN SUPERFLUID HELIUM. Gripshover, Ronald J.; Khoshnevisan, Mohsen; Zetts, Johns S.; Bass, Jack (Michigan State Univ., East Lansing). Phil. Mag.; 22: 757-77(Oct 1970).

The dependence of quenched-in resistance upon quench temperature and quenching speed for fine tungsten wires quenched under superfluid helium was studied. This resistance is described to vacancies trapped in the wires by the rapid quench. Extrapolation of the data to infinite quench speed produced a vacancy formation energy larger than the value of 3.3 eV proposed by Schultz. Analysis in terms of the theory of Flynn, Bass, and Lazarus yielded a vacancy formation energy of 3.6 ± 0.2 eV and a vacancy motion energy of 2.5 ± 0.5 eV, assuming an activation energy for self-diffusion of 6.1 ± 0.3 eV. The isochronal annealing spectrum after quenches from above 2800 K was also examined. Over 80% of the quenched-in resistance annealed away in a single, narrow stage, centered in the temperature range 850 to 1150 K. After quenches from below 3100 K, this stage was centered in the upper portion of this temperature range and contained essentially all of the quenched-in resistance. After quenches from higher temperatures, the annealing stage shifted toward lower temperatures, and some resistance remained after the stage was completed. Finally, isothermal annealing studies were made in the range 800 to 1040 K after quenches from above 3200 K. The isothermal annealing curves had a complex shape—the rate of annealing initially increasing with increasing annealing time. Measurements of changes in the rate of annealing upon changing the annealing temperature yielded an activation energy for migration of 1.5 ± 0.2 eV. This is considerably smaller than the high temperature estimate of 2.5 eV for the single vacancy motion energy. This low activation energy, the complex form of the isothermal annealing curves, and the persistence of some quenched-in resistance to high temperatures during isochronal annealing, are all suggestive of vacancy clustering during the quench and subsequent annealing. (auth) (UK)

695 STRUCTURE OF Gd_3Co. Strydom, O. A. W.; Alberts, L. (Rand Afrikaans Univ., Johannesburg). J. Less-Common Metals; 22: 511-15(Dec 1970).

A single crystal of the Gd_3Co intermetallic compound was prepared and its structure determined. The crystal was found to be orthorhombic with space group P_{bma}, and the cell dimensions are a = 7.05, b = 9.54, and c = 6.32 Å. Fractional atomic coordinates, structure factors, and interatomic distances are tabulated. (D.L.C.)

696 STRUCTURE OF THE EUTECTIC ALUMINUM-BERYLLIUM ALLOYS OBTAINED BY SOLIDIFICATION IN A SINGLE DIRECTION. Trottier, Jean-Pierre; Graf, Rene (ONERA, Chatillon, France). Compt. Rend., Ser. C; 271: 613-16(14 Sep 1970). (In French).

The solidification in a single direction of an Al-Be alloy containing 0.80 percent of Be in weight gave rise to an eutectic with a fibrous morphology. The reciprocal orientation of the two phases was determined by x ray crystallography and electron microscopy. The eutectic grains presented two growth orientations; one of which was due to the existence of Al dendrites at the beginning of solidification. A selective dissolution of the Al matrix gave rise to fibrous Be monocrystals. (auth) (France)

697 ATOM-PROBE FIM STUDIES OF VANADIUM, RHENIUM, AND A COPPER-BERYLLIUM ALLOY. Mueller, E. W.;

Krishnaswamy, S. V. (Pennsylvania State Univ., University Park). Phys. Status Solidi (a); 3: 27-31(16 Sep 1970).

The atom-probe field ion microscope reveals the interaction of the imaging gas with the surface by field-induced adsorption and by the effect on field evaporation. An advanced design of an atom-probe FIM is described. As the image gas interaction is chemically specific, experimental facts must be collected for the variety of metals of interest to field ion microscopy. The multiplicity of charge of field evaporating metals is found to be 2 and less frequently 3 for V, 2, mostly 3, and sometimes 4 for Re, and 1 or 2 for Cu and Be. Neon and argon both desorb with single and double charges. A Cu–Be alloy also shows multiple charged $CuBe_2$ molecular ions. (auth)

698 THIN STRUCTURE OF DEFORMED AND ANNEALED W MONCRYSTALS. Tiraspol'skii, V. I.; Kotlyar, A. A.; Grodskii, E. A.; (and others). Fiz. Metal. Metalloved.; 29: 175-9 (Jan 1970). (In Russian).

The effects of rolling and annealing on structural changes in thin-film monocrystalline W were investigated. Microhardness and electric conductivity measurements were used along with x-ray diffraction microscopy at specimen temperatures of 78°K in the study on the basis of these analyses; assumptions concerning mechanisms involved in cold deformation up to 30% in epsilon-phase W were established including step-like annealing. (J.R.D.)

699 RECRYSTALLIZATION OF ROLLED Be. Kornienko, L. A.; Nikolaenko, A. A.; Papirov, I. I.; Tukhinskii, G. F. (Physical Technical Inst., Kharkov). Fiz. Metal. Metalloved.; 29: 138-42(Jan 1970). (In Russian).

The dislocation structures in Be rolled at 400, 600, and 800°C and 88% deformed were studied using specimens annealed at 700 to 1000°C. The kinetics of new grain formation at initial recrystallization were also studied. The activation energies of these processes were determined as 75 ± 5 kcal/mole and 51 ± 4 kcal/mole respectively. (J.R.D.)

700 INVESTIGATION OF THE DEFORMATION CONTRAST ORGIN IN Ti–Nb ALLOYS BASED ON THE ZERO CONTRAST LINE POSITION. Sudareva, S. V.; Buinov, N. N.; Vozilkin, V. A.; Bychkova, M. I. (Inst. of Physics of Metals, Moscow). Fiz. Metal. Metalloved.; 29: 87-96(Jan 1970). (In Russian).

Electron micrographs of tempered Ti–Nb alloys reveal contrasting dark defect segments and a line of zero intensity. Theories of contrast are used in analysis of these defects. It was found that a metastable alpha-phase is associated coherently with the matrix and that the contrast is not associated with vacancy loops but is governed by fields of coherent deformation around alpha-phase or omega-phase particles depending on the structural state of the alloy. (J.R.D.)

Radiation Effects

Refer also to abstracts 180, 786, 1851, and 1888.

701 (AD–706004) POSTIRRADIATION CHARPY-V AND DYNAMIC TEAR SHELF LEVEL PERFORMANCE OF 12-IN. THICK A533-B PLATES AND WELD METAL. Hawthorne, J. R. (Naval Research Lab., Washington, D. C.). Apr 1970. 12p. (NRL–MR–2114). NTIS.

Charpy-V (Cv) and dynamic tear (DT) test comparisons at shelf level temperatures were developed for the irradiated condition of two 12-in.-thick A533-B steel plates and a submerged arc weld deposit. Individual plates were identified as HSST Plates Nos. 01 and 02; the weld prepared by Combustion Engineering was identified as weld 50. Low temperature (<300F) and elevated temperature (550F) irradiations were conducted. Fluences for the eight irradiation experiments ranged from 2 to 3×10^{19} n/cm^2 > 1 MeV. Experimental results indicate that the percent reduction in C_v shelf energy is comparable to the percent reduction in DT shelf energy/C_v shelf energy ratio for an individual material are retained under irradiation. Observations are in agreement with recent findings for A543 and other A533 steel plates. Ratio retention would permit the derivation of an approximate post-irradiation for DT shelf energy from post-irradiation C_v shelf energy for fracture safety analyses. (auth) (USGRDR)

702 (AD–707336) IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. Quarterly Progress Report, February 1–April 30, 1970. Steele, L. E.; Serpan, C. Z. Jr.; Hawthorne, J. R.; Krafft, J. M.; Gray, R. A. Jr. (Naval Research Lab., Washington, D. C.). 15 May 1970. 54p. (NRL–MR–2126). NTIS.

Results of a damage function approach to spectrum analysis for Army reactor SM-1 are described along with analysis for fracture resistance in heavy thickness A533-B steel plate and weld metal, the role of iron in the fracture of an irradiated pressure vessel steel, the nature of observed radiation damage in vanadium, and the effects of the fast reactor environment on the tensile properties of selected structural and cladding alloys. (auth) (USGRDR)

703 (BNWL–1349-2, pp 4.1-154) IRRADIATION DAMAGE TO REACTOR METALS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

Research and testing progress is presented on irradiation damage in reactor structural materials and fuel subassembly materials. Summaries of work are also included on fast reactor supporting studies related to fuel cladding characterization, creep and tensile properties of stainless steel, and stability of welds. (J.R.D.)

704 (BNWL–1349-2, pp 5.1-42) FAST REACTOR DOSIMETRY AND DAMAGE ANALYSIS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

A recommended set of flux and fluence monitor materials was selected to meet the fast reactor materials dosimetry center's objective of more consistent and accurate dosimetry in irradiation tests of candidate fast reactor fuels and materials. Use of this recommended set of monitor materials in irradiation tests will improve the accuracy of fluence estimates based on single monitors by ~10 to 30% from factors of 2 or larger, thus substantially improving the interpretation of irradiation effects data. Foil-monitored samples of stainless steel, pure elements, and crystalline compounds have been irradiated in EBR-II to obtain data on their helium production cross sections. Helium measurements with a mass-spectrometer system have been combined with multiple foil-derived neutron flux-spectra to obtain accurate (n,α) cross sections for these samples. The purpose of the control materials irradiation experiment is to provide data that can be used to predict gas release and structural changes which will occur during irradiation in a fast reactor. The capsule for this experiment includes a cadmium shield and boral filter to render neutron absorption rates more nearly comparable to those in FTR control rods. The cadmium and boron shielding will modify the flux spectrum at the sample to approximate a fast reactor spectrum. The flux and spectrum for the ETR experiment will be determined from both analytical and experimental work. A detailed and comprehensive transport theory calculation of the nuclear environment was completed; however, since this transport theory analysis has well-recognized inherent limitations, the experiment includes a comprehensive dosimetry effort to allow adjustment of calculated values. The simulation of displacement spike overlap in α-iron has been continued. Superposing defect cluster size distributions do not approximate the results well. Parameter variation studies with the Hybrid Anneal Program for bcc lattices have led to a significant decrease in running time, have shown the acceptability of a spherical recombination region, and have demonstrated the insensitivity of the results to small variations in correlation criteria. Programming has begun of a code to permit computer experiments on annealing in an fcc lattice. (auth)

705 (N–70-29887) CALORIMETRIC DETERMINATION OF RELATIVE GAMMA HEATING IN MATERIALS OF VARIOUS THICKNESSES AND ATOMIC NUMBERS. Reilly, Harry J.; Peters, Larry E. Jr. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). May 1970. 10p. (NASA-TM-X–2019; E–5587). NTIS.

A calorimeter was constructed to determine the relative amount of gamma heating in different materials as a function of thickness and atomic number. The experiment was performed in the Plum Brook Mockup Reactor, which has a typical light water test reactor gamma source spectrum. Carbon, aluminum, zirconium, tin, and lead specimens in slab geometry were irradiated. The results showed no significant difference in the gamma heating in carbon and aluminum, but the heating in the other materials was greater than that in carbon and aluminum. The smaller thicknesses had the greater heating. The results are believed to be applicable to nuclear reactor experiment designs and to other reactor problems as well. The calorimeter was also used to determine the gamma heating effect in an irradiation experiment mockup having cylindrical geometry. The result showed good agreement with an expected value calculated from the slab geometry data. (auth) (STAR)

706 (ORO–3612-7) INVESTIGATION OF IRRADIATION STRENGTHENING OF BCC METALS AND SOLID SOLUTIONS.

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Progress Report, January 1970–October 1970. (Maryland Univ., College Park). Contract AT(40-1)-3612. 7p. Dep. NTIS.

Results of postirradiation investigations of annealing mechanisms in V are reported that show there is no change in the effective stress due to anneal at 200°C. Other data are included associated with the trapping ability of neutron-induced defects. These data are presented graphically to show the ratio of internal friction at 0 peak temperature in annealed and irradiated V as function of interstitial oxygen distribution. (J.R.D.)

707 (ORO–3912-3) COMPUTER EXPERIMENT STUDIES ON MECHANISMS FOR IRRADIATION INDUCED DEFECT PRODUCTION AND ANNEALING PROCESSES. Progress Report for Period Ending February 28, 1970. Beeler, J. R. Jr. (North Carolina State Univ., Raleigh). Mar 1970. Contract AT(40-1)-3912. 44p. Dep. NTIS.

Most of the effort during this reporting period was devoted to finding out how to compute the characteristics of carbon-vacancy and carbon-interstitial complexes in nickel. The configuration energy of the carbon-vacancy complex is a double-valued function of the carbon atom position along a crystallographic direction through the vacancy. This feature was observed in fully dynamic simulations of Frenkel pair production near a carbon atom as well as in the variational and quasi-dynamic calculations where it was first discovered. This property makes the configuration state adopted by a carbon-vacancy complex depend sensitively upon the initial configuration from which the complex evolved. If the carbon atom entered into the complex by moving through a pre-existing vacancy, a low-energy configuration would result. If, however, the complex was formed by the displacement of a metal atom near an octahedral carbon atom, a high-energy state would be formed. Additionally, it is not easy for a complex to convert from the high-energy state to the low-energy state. A detailed description of suggested techniques for systematically computing binary impurity-lattice defect complex properties is given. These binary complexes are difficult to treat when the impurity-host atom interaction is significantly stronger than the host-host atom interaction. (auth)

708 EFFECT OF NEUTRON IRRADIATION ON THE GRAPHITIZATION OF MAGNESIUM CAST IRON. Markovskii, E. A.; Levchenko, Yu. N.; Krasnoshchekov, M. M. Liteinoe Proizvod.; No. 9, 19-20(Sep 1969). (In Russian).

The effect of neutron irradiation (10^{18} n/cm^2) on the graphitization of high-strength Mg cast iron and on the associated microstructure and mechanical properties was studied. Irradiation coarsened the ferrite lamellae (both free and pearlitic), owing to the diffusion of Fe atoms from the cementite, the pearlite microhardness falling from 200 to 190 kg/mm^2. Irradiation also intensified the diffusion of C atoms, promoting their departure from the cementite, although the size of the C aggregates remained below the critical graphitization value. The formation of flake graphite was nevertheless aided by neutron irradiation. (Metals Abstr.)

709 ACCELERATION OF ELECTROCHEMICAL PROCESSES ON REACTOR-IRRADIATED PLATINUM. Pyshnogravea, I. I.; Vasil'ev, Yu. B.; Zimakov, I. E.; Bagotskii, V. S.; Spitsyn, Vikt. I. Elektrokhimiya; 5: 1503-4(Dec 1969). (In Russian).

The electrochemical activity (e.g., in the evolution of O and H from H_2SO_4) of a smooth Pt electrode was studied before and after irradiation in a nuclear reactor. The induced radioactivity of the Pt electrode (due to the formation of the ^{197}Pt isotope, emitting β- and γ-rays) had a considerable accelerating effect on both anodic and cathodic electro-chemical processes subject to the absorption of a certain minimum degree of radioactivity. (Metals Abstr.)

710 EQUIPMENT FOR MECHANICAL TESTING OF RADIOACTIVE SPECIMENS. Metallurgia; 82: 103-4(Sep 1970).

Neutron irradiation alters the mechanical properties of steels, and allowance for these effects must be made in the design of nuclear power stations, particularly those with steel reactor pressure vessels. To confirm that the actual changes in properties are consistent with the allowance made in design, the Central Electricity Generating Board has set up test facilities at their Berkeley Nuclear Laboratories in Gloucestershire, to enable samples from each of the Board's nuclear stations to be periodically monitored. Prepared steel specimens were inserted in the reactors of working nuclear plants as they were built. The specimens are removed at intervals and subjected to physical tests in shielded chambers or cells at the laboratories. The tests are aimed primarily at measuring impact and tensile characteristics. Most steels investigated are of basically the same grade–silicon-killed, 1½% manganese, 0.15% carbon. Several hundred tests are made each year, the specimens including weld-metal, forgings and plate. For the impact tests, which are carried out across a range of temperatures from below zero to 300°C, the specimens are standard 10 mm square Charpy V-notch test pieces. To date, the programme has confirmed that radiation to the levels so far experienced in reactor pressure vessels does not have any serious effects on the mechanical properties of the materials tested. (UK)

711 VACANCY DAMAGE IN HEAVY ION AND NEUTRON-IRRADIATED TUNGSTEN. Buswell, J. T. (Central Electricity Generating Board, Berkeley, Eng.). Phil. Mag.; 22: 787-802(Oct 1970).

Vacancy damage produced by heavy ion, and neutron irradiation, of tungsten, at ambient temperatures, has been examined by both field ion and electron microscopy. Field ion microscopy revealed defects in the form of single vacancies, irregularly shaped voids (compact clusters) containing up to 300 vacancies, "dispersed" clusters, and both perfect and imperfect dislocation loops with Burgers vectors ½a⟨111⟩ and ½a⟨112⟩, respectively. At least 80% of the damage consisted of small clusters, each containing less than ten vacancies. The only defects that were readily resolved by electron microscopy were dislocation loops, with b = ½a⟨112⟩ or ½a⟨111⟩. Less than 10% of the total concentration of vacancies produced by irradiation was in the form of dislocation loops. Similar types of damage were produced by both heavy ion and neutron irradiations. Equivalent densities of damage were produced by doses 1×10^{17} (150 keV) Hg$^+$/m^2 and 5.42×10^{23} n$_f$/m^2. (auth) (UK)

712 STUDY OF NEUTRON IRRADIATION DAMAGE IN COPPER AND A DILUTE COPPER–BORON ALLOY. Barry, D. E.; Eyre, B. L. (Atomic Energy Research Establishment, Harwell, Eng.). Phil. Mag.; 22: 717-37(Oct 1970).

Transmission electron microscopy was used to examine irradiation-induced damage in pure copper and in a solid solution copper-0.001 wt % boron alloy after simultaneous neutron irradiation to an integrated fast neutron dose of 1.1×10^{20} cm^{-2} at ~60°C. The results demonstrate that the resolvable damage differs considerably in these materials, both in its initial distribution and in its post-irradiation annealing behavior; these differences are considered to be a consequence of the transmutation of the boron-10 atoms in the alloy. After post-irradiation annealing, the damage in both materials clearly consists of two components; coarsely distributed dislocation segments and loops and a finer distribution of small clusters. The annealing behavior of both components has been examined closely after annealing between 350 and 650°C, the temperature range in which the principal changes occurred, and the morphology and nature of the loops comprising the coarser component have been determined. Consideration is given to the mechanisms involved in the annealing of the damage, particular emphasis being placed on accounting for the significant influence exerted by the boron, helium and lithium atoms. Spherical precipitates, believed to result from aggregation of lithium atoms, have been observed in the alloy after annealing between 450 and 650°C. However, helium bubbles could not be detected and the possible reasons for this are discussed. (auth) (UK)

713 RADIATION-HARDENING AND RECOVERY IN MILD STEELS AND THE EFFECTS OF INTERSTITIAL NITROGEN. Little, E. A.; Harries, D. R. (Atomic Energy Research Establishment, Harwell, Eng.). Metal Sci. J.; 4: 188-95(Sep 1970).

The effects of interstitial nitrogen on the hardening produced in mild steels by irradiation at 50°C (323°K) to doses up to 2.6×10^{19} n/cm^2 (fission) were investigated. Materials were annealed silicon-killed steel with a finite concentration of nitrogen in solution, annealed silicon-killed steel in which the interstitial nitrogen had been progressively reduced by ageing at 650°C (923°K), and aluminium-grain-size-controlled mild steel with zero nitrogen in solution. The recovery of the radiation-hardening in the annealed silicon-killed steel was also studied. The irradiation-induced increases in the room-temperature tensile lower yield stresses were used as a measure of the radiation-hardening and the interstitial nitrogen contents were determined qualitatively from the strain-ageing behavior and quantitatively by low-frequency internal friction. It was concluded that nitrogen enhances the radiation-hardening in mild steels by increasing the defect-loop density and/or by stabilizing the small faulted (110) loops. The latter are inherently "stronger" with respect to dislocation interaction than the perfect loops on (111) planes observed in bcc metals irradiated to high doses, which are reported to be formed by shear and rotation when (110) loops achieve a critical size. (UK)

714 CORRELATION OF RADIATION-HARDENING WITH INTERSTITIAL NITROGEN CONTENT IN MILD STEELS. Little, E. A.; Harries, D. R. (Atomic Energy Research Establishment, Harwell, Eng.). Metal Sci. J.; 4: 195-200(Sep 1970).

The interstitial nitrogen contents of annealed En2, silicon-killed, and aluminium-grain-size-controlled high-manganese mild steels were determined quantitatively by internal-friction and chemical methods and qualitatively by strain-ageing. Comparison of the results with previously published data on the effects of neutron irradiation on the room-temperature tensile lower yield stresses of the

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steels showed that the magnitude of the radiation-hardening increased with increasing interstitial nitrogen content. The interstitial nitrogen and the radiation-hardening in the annealed silicon-killed mild steel were decreased by ageing at 650°C (923 K) before irradiation, presumably as a result of the nitrogen in solution combining with the silicon, forming silicon nitride or silicon-manganese nitride. The strain-ageing in the annealed and annealed and aged silicon-killed mild steel was reduced after irradiation, indicating that the interstitial nitrogen was removed from solution. It is tentatively concluded that the interstitial nitrogen atoms were trapped by the point defects or defect clusters introduced during irradiation and that the radiation-hardening was enhanced as a consequence of the effects of the nitrogen trapping on the size, density, and/or intrinsic strength of the defect clusters. (auth) (UK)

715 SPECIMEN PREPARATION FOR TRANSMISSION ELECTRON MICROSCOPY OF HEAVY-ION-BOMBARDED TYPE 316 STAINLESS STEEL. Brager, H. R.; Kissinger, H. E.; Kulcinski, G. L. (Battelle-Northwest, Richland, Wash.). Contract AT(45-1)-1830. Radiat. Eff.; 5: 281-3(Oct 1970).

A technique is described for thinning samples of 5-MeV Ni^{2+} ion-bombarded Type 316 stainless steel specimens to any predetermined distance from the original ion-bombarded surface. X-ray absorption is used to monitor specimen thickness and electropolishing rates. After the ion-bombarded surface is coated with a "stop-off" lacquer, the reverse side is jet electropolished to produce a dimple, which is immersion electropolished with interruptions for thickness monitoring. When the required depth is reached, the stop-off lacquer is removed and both sides are etched until light penetration is reached. Equations fitting the polishing rates for the flat and dimpled surfaces are given, together with a typical micrograph. (D.L.C.)

716 TEMPERATURE RISE IN ELECTRON-IRRADIATED FOILS. Fisher, S. B. (Central Electricity Generating Board, Berkeley, Eng.). Radiat. Eff.; 5: 239-43(Oct 1970).

The temperature rise in thin metallic foils under intense electron irradiation has been computed as a function of beam conditions, electron energy, and the physical properties of the foil. The model due to Gale and Hale was used in conjunction with the corrected Bethe electron energy loss formula for relativistic electrons. Although the nature of the assumptions made renders the results generally unapplicable to low thermal conductivity materials, a set of beam conditions etc. are specific for the particular case of a small temperature rise in a ceramic foil (UO_2). (auth)

717 STAGE V RECOVERY IN VIa bcc METALS. Pande, B. M.; Goedeme, G.; Stals, L.; Nihoul, J. (SCK-CEN, Mol, Belg.). Radiat. Eff.; 5: 153-5(Oct 1970).

A resistometric study at 4.2°K of the high-temperature recovery spectrum of neutron-irradiated molybdenum as a function of fast fluence and of cold-worked molybdenum as a function of the heating program, yields evidence against vacancy migration in the 0.31 T_m stage for VIa bcc metals. (auth)

718 ATHERMAL STRESS COMPONENT IN NEUTRON IRRADIATED MILD STEEL. Little, E. A. (Atomic Energy Research Establishment, Harwell, Eng.). Radiat. Eff.; 5: 149-52 (Oct 1970).

The temperature dependence of the tensile lower yield stress of an annealed aluminium grain size-controlled mild steel has been investigated in the range 23 to 250°C and at a strain rate of 1.67×10^{-4} sec^{-1} before and after neutron irradiation to 2.3×10^{18} n/cm^2 (fission). The yield stress of the irradiated steel decreases with increasing temperature due to thermal activation of the radiation damage and is predicted to reach asymptotically that of the unirradiated steel at ~285°C; the maximum test temperature was below that at which thermal annealing of the damage occurs. This implies that the athermal stress component due to irradiation is zero and hence there is negligible long range interaction between dislocations and radioinduced defects. (auth)

Ceramics and Cermets

Refer also to abstracts 1 and 614.

Corrosion and Erosion

Refer also to abstract 621.

719 (DP-Report-419) THE INFLUENCE OF MASS TRANSFER ON THE KINETICS OF GRAPHITE OXIDATION BY LOW CONCENTRATIONS OF OXIDISING IMPURITIES IN AN INERT CARRIER GAS. Project DRAGON. Valette, L.; York, J. (Atomic Energy Establishment, Winfrith (England)). Apr 1966. 54p. (CONF-660468-1). Dep. NTIS.

From International Conference on the Phenomena of Transport with Change of Phase in Porous or Colloidal Media, Paris, France.

Results of investigations are reported on the effects of molecular diffusion and forced convection on the reactions of trace impurities in He coolant with graphite. Most results are associated with the laminar flow region. Theoretical and semi-empirical expressions for turbulent flow are also included. (J.R.D.)

Preparation and Fabrication

Refer also to abstracts 38, 249, 628, 631, 640, and 641.

720 (BNWL-1349-2, pp 2.1-12) FAST-REACTOR CERAMIC FUELS RESEARCH. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

Mixed oxide $(U_{0.75},Pu_{0.25})O_2$ creep specimens have been hot pressed from coprecipitated powders to densities exceeding 10.90 g/cm^3. Specimens hot pressed in molybdenum die liners show uniform, large grained microstructures; specimens hot pressed in unlined graphite dies show grain size increases from edge to center. High-temperature creep measurements in four-point bending on 99.5% TD UO_2 specimens yield an activation energy of 95 kcal at temperatures of 1450 to 1490°C and stress levels of 2×10^3 to 10×10^3 psi. Stress dependence of strain rate increases at high stresses. Creep rates at a given stress decrease after cycling over a range in stress. Porosity alignment relative to stress orientation indicates that grain boundary sliding is an important mechanism for the observed creep. A test to evaluate the source of chronic specimen breakage during in-reactor creep tests has been designed, and a capsule is ready for irradiation. Modifications to the existing tensiometric apparatus for phase studies to allow operation to 1600°C are complete. Data points obtained at 1100°C are in good agreement with the data of Markin between $\Delta\bar{G}(O_2)$ of −100 and −130 kcal/mole. A method for determination of O/M ratio (e.g., total oxygen content) on ~1 mg samples of oxide fuel material using quantitative chromatography is feasible. The major problem is removing extraneous sources of CO from the system used in reduction of the oxides with graphite. Results of runs performed with a tungsten crucible and graphite indicate that graphite can be outgassed to negligible CO contribution. However, the quartz vessel was tentatively identified as contributing significantly to the CO blank by thermal desorption. (auth)

721 (CEA-CONF-1632) STUDY OF U-Pu-C-M CARBIDES. Bocker, Shimon; Boucher, Rene; Lorenzelli, Robert; Milet, Claude (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 9p. (In French). (CONF-701001-11). Dep. NTIS (U. S. Sales Only).

From 4th International Conference on Plutonium and Other Actinides, Santa Fe, N. Mex.

Additions were made to U-Pu-C in an attempt to improve the properties and facilitate the manufacture of this type of fuel by eliminating the phases $(U-Pu)C_2$ and $(U,Pu)_2C_3$. The systems U-Pu-C-Zr, U-Pu-C-Ti and U-Pu-C-Mo with small additions (~3 at.%) of the element M and a ratio Pu/U + Pu equal to 20 or 25% were investigated. Two manufacturing processes were studied. By arc melting in graphite molds, the carbides U-Pu-C-Mo and U-Pu-C-Ti cast easily, and U-Pu-C-Zr with more difficulty. By sintering, the carbide is formed at 1400°C from $(U,Pu)H_3$ + C + M, and sintering is carried out under vacuum between 1400 and 1750°C according to the density required; the compounds U-Pu-C-Ti and U-Pu-C-Mo sinter easily but a double sintering is necessary for U-Pu-C-Zr. According to the system considered, the monophase (U,Pu)C is replaced by a single phase (U,Pu,Zr)C, by two phases (U,Pu)C + TiC, or by three phases (U,Pu)C + $(U,Pu)C_{1.7}$ Mo + Mo. So far as compatibility with 316 stainless steel is concerned, there is little difference between U-Pu-C (monophase, stoichiometric) and two-phase U-Pu-C-Ti. With U-Pu-C-Zr and U-Pu-C-Mo a distinct improvement is observed, no diffusion of carbon being detected by micrography up to at least 925°C. The thermal conductivity, deduced from thermal diffusivity measurements between 20 and 1500°C, is considerably improved with respect to sintered U-Pu-C in the case of carbides alloyed with Mo (cast or sintered), Ti and Zr (cast); the thermal conductivity remains about the same in the case of sintered carbides alloyed with Zr. The thermal expansion coefficients measured between 20 and 1500°C are very similar to those of U-Pu-C. Resistance to atmospheric corrosion at 25°C is better than that of cast U-Pu-C for the three systems studied. (auth) (France)

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722 (CONF-700403-(Vol.1), pp 193-200) THULIUM OXIDE MICROSPHERE PREPARATION AND CHARACTERIZATION. Ambrose, C. J. (McDonnell Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Thulium-170 is a potential candidate for a short duration radioisotope fuel for a heat source. An experimental program was initiated to prepare microspheres of thulia, coat the microspheres with tungsten, and irradiate the non-radioactive thulia-169 to form radioactive thulium-170. Modifications in the sol-gel process were necessary to produce thulia microspheres. The thulia microspheres were fragile and necessitated a careful handling technique. Dense microspheres of $^{169}Tm_2O_3$ were achieved by calcining the microspheres at 1400 to 1500°C in air. Shrinkage measurements on the spheres after removal from the alcohol showed an overall reduction of 43% at the elevated temperatures. The load required to crush the microspheres was about 1500 grams for microspheres fired at 1000 or 1100°C. X-ray analysis of microspheres fired at various temperatures yielded the following results: 500°C in vacuum-amorphous, 1000°C in air-cubic, and 1500°C in air-cubic phases. High-temperature-fired microspheres were used for the testing program. Coating experiments were conducted using a chemical vapor deposition technique to apply a uniform dense tungsten deposit. Hydrogen and tungsten hexafluoride were thermally decomposed in the fluidized bed of thulia microspheres to form the tungsten coating. Approximately a 20 volume-percent coating was applied on the spheres. (auth)

723 (CONF-700403-(Vol.2), pp 582-7) HIGH-PRESSURE SYNTHESIS OF NEW HEAVY RARE EARTH CARBIDES. Krupka, M. C.; Krikorian, N. H. (Los Alamos Scientific Lab., N. Mex.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume II. Sessions I through M.

The solid state synthesis of a number of heavy lanthanide bcc carbides in both the $MC_{0.75}$ and $MC_{1.50}$ composition regions was achieved. Carbide systems investigated included those of Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y. The bcc carbides were of the Pu_2C_3-type (anti-Th_3P_4) belonging to space group $143d-T_d^6$. In the $MC_{1.50}$ region, Er_2C_3, Tm_2C_3, and Yb_2C_3 were prepared. These were pressure-stabilized phases reverting back to low symmetry phase or phases upon subsequent annealing. In the $MC_{0.75}$ region, M_4C_3 carbides (where M = Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y) were prepared. In some cases these lower carbides can be prepared by long-term annealing. High pressures were used primarily to enhance the formation rate. Lattice parameters for the new carbides as well as a short discussion on structure are presented. (auth)

724 (DP-Report-2) DRAGON PROJECT GRAPHITE SYMPOSIUM. Project DRAGON. Schmidt, Hans (Atomic Energy Establishment, Winfrith (England)). Feb 1960. 6p. (NP-9382). Dep. NTIS.

The symposium was held to inform the participants concerning graphite technology in the Dragon Project. Progress in procurement of suitable graphites is reported and data are given on various raw materials and methods of impregnation. (J.R.D.)

725 (DP-Report-315) DIFFUSION IN COATED PARTICLE FUEL. Project DRAGON. Fally, J. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Jan 1965. 102p. (CONF-641031-3). Dep. NTIS.

From Symposium on Basic Research, Harwell, Eng.

The kinetics of interaction between thorium/uranium kernels and pyrolytic carbon coatings is examined. From the thickness of the graphitized zone in the initial pyrolytic carbon layer it is possible to conclude that the graphitization is essentially controlled by a diffusion mechanism and that coating conditions have no influence on the speed of graphitization. Simultaneously it was found that pyrolytic coatings deposited at high temperatures are less permeable to thorium and uranium than those deposited at low temperatures, suggesting that the diffusion mechanism is not the only one participating in the interaction between the kernel and the coating. (auth)

726 (DP-Report-318) FABRICATION OF SPHERICAL CARBIDE PARTICLES. Project DRAGON. Huet, J. J. (Atomic Energy Establishment, Winfrith (England)). Feb 1965. 17p. (CONF-641031-6). Dep. NTIS.

From Symposium on Basic Research, Harwell, Eng.

Preparation of carbon-coated ThC–UC fuel particles for the Dragon reactor is described. Information is included on furnace design, sintering conditions, reaction rates and shrinkage. The starting materials used were ThO_2 and UO_2 particles. (J.R.D.)

727 (LA-4495) CERAMIC COATINGS USED IN CASTING PLUTONIUM AND ITS ALLOYS. Harbur, D. R.; Robbins, B. N.; Romero, J. W. (Los Alamos Scientific Lab., N. Mex.). Sep 1970. Contract W-7405-eng-36. 3p. Dep. NTIS.

Many ceramic materials are inert to molten plutonium, but fragility and porosity of ceramic crucibles make them impractical for use in the plutonium foundry. Oxidized tantalum crucibles are inert to pure plutonium and to some of the low-melting-point alloys of plutonium. To take advantage of the ruggedness of metal crucibles, ceramic coatings inert to plutonium alloys at high temperatures that can be applied to metal or graphite crucibles and molds were developed. Descriptions of these coatings and the processes by which they are applied are given. (auth)

728 (WARD-4135-11) OXIDE FUEL ELEMENT DEVELOPMENT. Quarterly Progress Report for the Period Ending June 30, 1970. (Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.). Sep 1970. Contract AT(30-1)-4135. 132p. Dep. NTIS.

Research is reported on effects of neutrons on stainless steel-clad oxide fuels. Other work is reported directed toward development of computer programs for calculating oxide fuel behavior over the range of parameters characteristic of the LMFBR. Investigations of radiation effects on unencapsulated oxide fuel pins are described along with testing and development of grid-type fuel assemblies for LMFBR and EBR-II. Development of processes for fabrication of mixed oxide fuel pellets and characterization of these pellets are described. (J.R.D.)

729 (WHAN-FR-8) ACTIVATION OF SOME UO_2 POWDERS BY MILLING AND OXIDATION-REDUCTION. Barr, M. J. (WADCO Corp., Richland, Wash.). Sep 1970. Contracts AT(45-1)-1830; AT(45-1)-2170. 32p. Dep. NTIS.

The effect of varying the activity of some UO_2 powders by various material treatments was evaluated by calcining small portions of ceramic grade normal UO_2 in nitrogen and in air to 400, 600, and 800°C. Portions of 93.15% enriched UO_2 powder were activated using the oxidation-reduction technique. Powder characteristics determined on as-received and activated powders included particle size distribution, O/U ratio, B. E. T. surface area, tap density, and scanning electron micrographs. Pellet characteristics obtained from sinterability specimens included green and sintered pellet theoretical density, and sintered pellet microstructure. The particle characteristics determined were evaluated against changes in density and sintered pellet microstructure. (auth)

730 CRYSTAL GROWTH OF β-RHOMBOHEDRAL BORON. Borchert, W.; Dietz, W.; Koelker, H. (Technische Hochschule, Munich. Consortium fuer Elektrochemische Industrie GmbH, Munich). Z. Angew. Phys.; 29: 277-81(13 Aug 1970). (In German).

The zone melting of boron by means of radio frequency induction heating and by a new plasma heating was investigated. In induction heating the skin depth of the eddy currents in boron was not infinitely small and the heat was generated below the surface. There was a radial flow of heat which gave rise to a considerable temperature gradient, so that the phase boundary was always concave near the surface. To avoid radial temperature gradients heat had to be generated only on the surface of the boron rod. In order to accomplish this a new plasma heating was used which implied radio frequency gas discharges in H_2 between water cooled metal electrodes. Big single crystals of boron were grown by this new technique. The current-voltage-characteristic of the gas discharge was investigated for different electrode distances and gas pressures. (auth)

731 OPTICAL THIN SECTION MICROSCOPY OF PYROLYTIC SILICON CARBIDE. Walker, Durham E. Y. (United Kingdom Atomic Energy Authority, Salwick, Eng.). Prakt. Metallog.; 7: 445-54(Aug 1970). (In German and English).

A method is described for the preparation of thin sections of very small SiC specimens. Examination of the thin sections revealed that SiC deposited on a UC granule in a fluidized bed varied in structure according to coating rate. At slow rates, SiC had an optically transparent radial columnar structure, which contained some thin radially disposed sheets of an optically anisotropic material, which was most probably disordered α-SiC. (auth)

732 UTILIZING LITHIUM OXIDE AND PRECURSORS AS SINTERING AID FOR HOT PRESSING BERYLLIUM OXIDE. Hendricks, Rudolph Jr. (to United States Atomic Energy Commission). U. S. Patent 3,529,046. 15 Sep 1970. Filed 20 Jun 1968.

High-purity, theoretically dense beryllium oxide products are produced at reduced temperatures and pressures by utilizing a

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fugitive-type sintering aid and beryllium oxide powder. A mixture of beryllium oxide powder and about 0.5 weight percent lithium oxide, added either as lithium oxide or a precursor of lithium oxide, is hot-pressed at a temperature of about 950°C and a pressure of 1500 to 2000 psi to form theoretically dense products. The product may be subsequently heat-treated at about 1000 to 1400°C for removing virtually all the lithium oxide remaining in the product to provide a product of high purity. (auth)

733 CERAMIC MATERIAL FOR MAGNETOHYDRODYNAMIC GENERATOR ELECTRODE. Yerouchalmi, David (to Commissariat a l'Energie Atomique). British Patent 1,208,713. 14 Oct 1970. Priority date 24 Jan 1968, France.

A ceramic material consisting mainly of an alkaline earth zirconate such as $SrOZrO_2$ with an additive such as Al_2O_3 or Cr_2O_3 is described for use in MHD generator electrodes. The presence of the additives promotes electron conductivity and prevents evaporation of strontium zirconate. (J.R.D.)

734 PRELIMINARY REPORT ON THE EVALUATION OF UO_2 FOR THE MANUFACTURE OF FUEL ELEMENTS. Nishioka, Isao; Pedro de Antunes Bueno, Ricardo; Capocchi, Jose Deodoro Trani. Metalurgia (Sao Paulo); 25: 733-40(Oct 1969). (In Portuguese).

Results of differential thermal analysis, measurement of specific surface and determination of the O:U ratio in samples of UO_3, prepared from ammonium diuranate of nuclear purity, are discussed. The implications of the findings with regard to the sinterability of the powders are evaluated. Data on methods used to produce the powders and descriptive information on intermediate products are included. The powders were of nonstoichiometric composition; the deviation from stoichiometry favored high sintered densities. (Metals Abstr.)

735 ZIRCON AND ZIRCONIA REFRACTORY MATERIALS. ZIRCONIUM COMPOUNDS USED FOR REFRACTORY MATERIAL AND BRICKS. Mutoh, Shigeki; Indo, Masakazu (Shinagawa Fire Brick Co. Ltd., Tokyo). Shin Kinzoku; No. 52, 6-13(Mar 1970). (In Japanese).

With the rapid advance of industries in Japan, the demand for refractory materials with superior quality at extremely high temperatures is increasing tremendously. The zircon refractory material, once considered as a rare material, is now common, and production is gradually rising. As for zirconia refractory material, although its use is still limited due to high cost, it is being used extensively in such industries as steel manufacturing, petrochemistry, and ceramics. The world supply of zirconium-containing minerals, and the chemical composition of zircon and zirconia sources are described. The production procedure, properties, and use of zircon refractory material, zircon refractory bricks, zirconia refractory material, zirconia–alumina–silica refractory material, and other zircon refractory material are reviewed. (Japan)

736 PROCESS FOR THE PRODUCTION OF URANIUM DIOXIDE. (to NUKEM Nuclear-Chemie und-Metallurgie Gesellschaft mbH). British Patent 1,206,048. 23 Sep 1970. Priority date 1 Mar 1967, Germany.

A process for the production of sinterable UO_2 powder comprises feeding moist ammonium uranyl carbonate and/or ammonium diuranate into a fluidized bed heated to 500 to 600°C with a steam–hydrogen atmosphere. Free flowing UO_2 is formed. (B.L.M.)

737 MANUFACTURING PROBLEMS OF ADVANCED FUELS. Bairiot, H.; Haubert, P.; Libotte, P.; Storrer, J. (Belgonucleaire, Brussels). Nucl. Eng. Int.; 15: 811-16(Oct 1970).

Developments in fuel manufacturing processes and advanced uranium fuels and plutonium fuels for present and future types of commercial power reactors offer lower fabrication costs, higher burn-up and higher fuel rating. Practical manufacturing and technical problems of pelleted and vibrated fuels and coated particles are reviewed together with considerations of economics and ultimate acceptability of the advanced fuels. (auth) (UK)

738 MANUFACTURE OF CERAMIC ARTEFACTS HAVING PORES. Horsley, Geoffrey Winton; Burnett, Ronald Cyril (to United Kingdom Atomic Energy Authority). British Patent 1,208,433. 14 Oct 1970. Filed 20 Apr 1967.

Fabrication of nuclear fuel by powder metallurgy techniques that will introduce closed pores into the bulk fuel to accommodate swelling under irradiation and thus produce a more stable product without excessively reducing the fuel density is proposed. The more uniformly the pores can be distributed within the fuel the more effectively this goal is attained. The process described is particularly applicable to oxides and carbides of metals that show multivalency. It consists of heating the higher valency compound for densification without lowering the valency, then heating the densified product in a reducing atmosphere for a time sufficient to increase the porosity by lowering the valency and removing O or C leaving pores. The compound may be U_3O_8, in which densification is induced by heating in an oxidizing atmosphere or UC_2 wherein densification is accomplished by heating in a carbonizing atmosphere. The body may be spherical, produced by gyrating U_3O_8 particles with an organic binder, such as n-decanol. The fuel element may also be composed of plutonium and uranium oxides or carbides. Densification may be accomplished by heating at 800 to 1000°C for 1 to 4 hours, and reducing accomplished at a temperature of about 1000°C for 1 to 4 hours. The reducing atmosphere may be CO. (UK)

739 PREPARATION OF SINTERED UO_2 PELLETS FROM POWDERED U_3O_8. II. EFFECT OF QUALITY OF STARTING MATERIAL AND OF BINDERS USED FOR COMPACTING U_3O_8 ON REDUCTION-SINTERING PROCEDURE. Landspersky, Hanus; Bezucha, Jaromir (Inst. of Nuclear Research, Rez, Czech.). Jad. Energ.; 16: 289-92(Sep 1970).

The method of simultaneous reduction and sintering of pressed U_3O_8 pellets was verified with materials of Czechoslovak origin and its feasibility was proved. A sufficiently low rate of temperature increase in the region of 20 to 500°C made it possible to prepare sintered UO_2 pellets having ≥95% TD. The addition of binders (polyvinyl alcohol and polyethylene glycol) did not complicate the process which in the most cases progressed as if binders were not added. In addition, activated sintering in some cases took place, which made it possible to sinter even less active materials to high final densities. (auth)

Properties Evaluations

Refer also to abstracts 317, 658, 678, 682, 1317, 1327, and 1889.

740 (AD–474854) METALLURGY AND PROPERTIES OF THORIA-STRENGTHENED NICKEL. Rice, Leonard P. (Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center). 1 Oct 1965. Contract AF33(615)-1121. 36p. (DMIC-Memo-210). NTIS.

The metallurgy and properties of thoria-strengthened nickel, a material which shows promise as a structural metal for use at 1900 to 2400 F where the present nickel- and cobalt-base superalloys lose most of their useful strength, are summarized. Discussed are methods of producing dispersions in metals and the processing variables involved in making dispersion-strengthened nickel. An entire section on the mechanical properties of thoria-strengthened nickel is included. Given in this section are tensile, creep-rupture, shear, and fatigue properties, as well as the effect of various thermal and mechanical treatments on the materials. Physical-property data comprise one section and oxidation resistance another. In a section on joining the following joining processes are discussed: resistance welding, flash welding, brazing, diffusion bonding by hot pressing, electron-beam welding, fusion welding, and others. In the last section an outlook for future developments of dispersion-strengthened nickel is presented. (USGRDR)

741 (AECL–3655) THORIUM DIFFUSION IN THORIA AND URANIA. King, A. D. (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Aug 1970. 50p. Dep. NTIS (U. S. Sales Only). AECL $1.50.

Techniques are described for the measurement of ^{229}Th diffusion in ThO_2 and UO_2. Results are presented for single crystal ThO_2 in the range 1850 to 2000°C and single crystal UO_2 at 1575°C. The diffusion profiles are interpreted in terms of lattice and dislocation diffusion coefficients. Previous data on cation diffusion in ThO_2 and UO_2 are discussed. (auth)

742 (CONF-700403–(Vol.1), pp 201-12) PROPERTIES OF THULIUM OXIDE MICROSPHERES PREPARED BY SOL–GEL METHODS. Buxton, S. R.; Lloyd, M. H.; Willmarth, T. E. (Oak Ridge National Lab., Tenn.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The sintering behavior of thulium oxide microspheres prepared by sol-gel techniques was investigated. In these studies, the micelles of the hydrosols used to prepare the microspheres varied from highly distinctive crystalline forms to very small amorphous particles. A procedure for preparing lanthanide oxide microspheres of controlled particle size by sol-gel techniques has been previously described. This procedure utilizes highly crystalline sols; however, with suitable modifications, it can also be used to prepare microspheres from sols composed of small amorphous particles. Several properties relative to sintering behavior were

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found to be functions of the sol crystalline habit. The results suggest that the characteristics of lanthanide oxide microspheres can be tailored to provide the desired variations in crushing strength, density, porosity, and densification temperature. (auth)

743 (CONF-700403-(Vol.1), pp 224-33) THE RELATIVE STABILITIES OF THE B AND C FORMS OF Sm_2O_3, Eu_2O_3, AND Gd_2O_3. Fitzgibbon, George C.; Pavone, Daniel; Holley, Charles E. Jr. (Los Alamos Scientific Lab., N. Mex.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

The enthalpies of solution of the B (monoclinic) and C (cubic) types of Sm_2O_3, Eu_2O_3, and Gd_2O_3 were measured in hydrochloric acid, and of Eu_2O_3 in nitric acid. It appears that for Eu_2O_3 and Gd_2O_3 the C form is the stable form at 298°K, and for Sm_2O_3 there remains considerable uncertainty. (auth)

744 (CONF-700403-(Vol.1), pp 366-74) STUDIES OF THE DIVALENT OXIDES OF THE RARE EARTHS. McCarthy, Gregory J.; White, William B.; Roy, Rustum (Pennsylvania State Univ., University Park. Materials Research Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

The stability of divalent compounds of the rare earths was examined in relation to the crystal chemical parameters of field strength and electronegativity. Europium compounds of AX stoichiometry form over the full range of electronegativity but oxides and fluorides of Sm^{++} and Yb^{++} are destablized. Ternary compounds of Eu^{++} form over the full range of field strength and electronegativity difference. Divalent samarium and ytterbium are stabilized only by covalently bonded anions of high field strength and low electronegativity difference. (auth)

745 (DP-Report-209) THE CORRELATION BETWEEN PORE SIZE DISTRIBUTION, PERMEABILITY, AND DIFFUSION IN GRAPHITE. Project DRAGON. Schloesser, J. (Atomic Energy Establishment, Winfrith (England)). Jan 1965. 24p. (CONF-630605-2). Dep. NTIS.

From Symposium on Graphite Physics, Diffusion, and Carbon Transport, Harwell, Eng.

It is shown that the results of back diffusion experiments can be used for evaluating an effective pore size distribution for graphite which is related only to the through pores. Using this pore spectrum other flow phenomena can be calculated. The theoretical model, a bundle of capillaries with different diameters, is verified on four different graphites and the predicted permeable behavior has been found to agree well with the measured one. (auth)

746 (DP-Report-317) MICROPHOTOGRAPHIC EXAMINATION OF THE FIRST STAGES OF CARBON DEPOSITION FROM CARBON MONOXIDE ON IRON SURFACES. Project DRAGON. Hennaut, J.; Waty, J.; Warzee, M.; Ruston, W. R. (Atomic Energy Establishment, Winfrith (England)). Feb 1965. 22p. (CONF-641031-5). Dep. NTIS.

From Symposium on Basic Research, Harwell, Eng.

Results obtained in the study of carbon deposition from carbon monoxide on iron specimens at 550°C are presented. The distribution of carbon deposition on the surface of polished, polycrystalline specimens has been studied under the microscope for various partial pressures of carbon monoxide and times of exposure. Examination of polished sections of these specimens has shown that cementite is formed within the metal by intergranular attack, the depth of penetration increasing with time of exposure. Chemical analysis of the deposited carbon has shown it to contain iron. The structure of the carbon has been investigated using an electron microscope. (auth)

747 (DP-Report-331) CARBON DEPOSITION STUDIES. Project DRAGON. Everett, M. R.; Kinsey, D. V. (Atomic Energy Establishment, Winfrith (England)). May 1965. 34p. (CONF-641031-2). Dep. NTIS.

From Symposium on Basic Research, Harwell, Eng.

A theoretical explanation is proposed concerning the experimentally observed peak in carbon deposition from carbon monoxide at 500°C on iron surfaces. This explanation requires that gas equilibria in the $Fe-H_2-H_2O-CO-CO_2$ system permit reduction of surface oxide and formation of a catalytically active carbide. The $H_2:H_2O$ ratio and the partial pressure of H_2O are the critical parameters. Experimental results are presented which show that carbon deposition rates on mild steel surfaces can be high enough to merit careful consideration in the design of HTGCR's. Results of the metallurgical examination of steel specimens subjected to carbon deposition conditions at 500°C are given. (auth)

748 (LA-4462-TR) SHORT-TERM STRENGTH, CREEP, AND DUCTILITY OF GRAPHITE AT 300 TO 3500°K. Dergunov, N. N.; Barabanov, V. N.; Kurakin, V. M.; Zaitsev, G. G.; Strokov, V. I.; Abrakhimov, U. Translated by Helen J. Dahlby (Los Alamos Scientific Lab., N. Mex.) from Termoproch. Mater. Konstr. Elem.; No. 5, 354-61(1969). 5p. Dep. NTIS.

A facility and procedure for studying the short-term tensile impact and compression strength, creep, and ductility of graphite at temperatures from 300 to 3500°K are described. Experimental data on the mechanical characteristics and changes in the creep rate and ductility of three grades of graphite in this temperature range are examined. (auth)

749 ANALYSIS OF STRESS-DEFORMATION IN GRAPHITE. Gobin, P.; Merlin, J.; Jouquet, G.; Rappeneau, J. (Institut National des Sciences Appliquees, Lyon). J. Nucl. Mater.; 34: 212-14(Feb 1970). (In French).

The three models previously proposed to describe the stress-deformation curves of graphite are examined and the equivalence among them led to the proposal of a simple empirical law to describe the stress-deformation curves. The expression derived describes the behavior of graphite exposed to mechanical stress, but it does not describe the behavior rigorously. The expression is valid both for compression and torsion if the compression coefficients are replaced by the shearing coefficients. (J.S.R.)

750 COMPOSITE SOLIDIFICATION IN THE SYSTEMS Cr_2O_3-Mo, Cr_2O_3-Re, Cr_2O_3-W, AND MgO-W. Nelson, R. P.; Rasmussen, J. J. (Battelle-Northwest, Richland, Wash.). J. Amer. Ceram. Soc.; 53: 527(Sep 1970).

Crucibles fabricated from Mo, Re, and W were investigated for compatibility with molten Cr_2O_3 and MgO during a study of the properties of several molten oxides. In all systems, the crucible and the oxide interacted rapidly at the onset of melting, usually causing failure of the container and some loss of oxide. Microstructural studies of the solidified melt revealed the nature of the interaction. In each case, similar eutectic-like composite microstructures were observed. (auth)

751 ANOMALOUS INCREASE IN HARDNESS WITH INCREASE IN GRAIN SIZE OF BERYLLIA. Armstrong, R. W. (Univ. of California, Livermore); Raymond, E. L.; Vandervoort, R. R. J. Amer. Ceram. Soc.; 53: 529-30(Sep 1970).

The low-temperature strength of BeO was studied by hardness testing. The relation between hardness and grain size indicated that the direct change in the grain size of BeO might not be the primary factor determining the polycrystalline strength. The relative hardness level of the monocrystal results showed that grain boundaries contributed to weakening of the BeO polycrystalline material even at low temperature. (G.M.C.)

752 RELATIONS BETWEEN CRYSTALLINE PHASES, CRYSTAL SIZE, WATER LOSS, AND THERMOLUMINESCENCE IN THE SYSTEM ZrO_2-H_2O. Bettinali, C.; Ferraresso, G. (Univ., Rome). J. Amer. Ceram. Soc.; 53: 495-7(Sep 1970).

The effects of thermal treatment, crystalline phases, and crystal size on thermoluminescence in the system ZrO_2-H_2O were studied. The results suggest that thermoluminescence is not affected by the water content and that it is strongly dependent on the degree of crystallinity and on crystal size. An interpretation of the changes in the glow curves is suggested on the basis of the data. (auth)

753 REACTION OF UC WITH NITROGEN FROM 1475° TO 1700°C. Leitnaker, J. M.; Lindemer, T. B.; Fitzpatrick, C. M. (Oak Ridge National Lab., Tenn.). J. Amer. Ceram. Soc.; 53: 479-81(Sep 1970).

The reaction of nitrogen with arc-melted UC was studied from 1475 to 1700°C at an N_2 pressure of about 400 torr. The reaction appeared to proceed toward equilibrium in distinct stages: UC and N_2 reacted to form UC_2 and $UC_{0.8}N_{0.2}$; UC_2 reacted with N_2 to produce more $UC_{0.8}N_{0.2}$ and free C; and this U(C,N) reacted with N_2 to produce more free C and the equilibrium product, a high-N U(C,N). These results are consistent with known thermodynamic and phase behavior in the U-C-N system. (auth)

754 ENTHALPY OF FORMATION OF ZIRCONIUM CARBIDE. Baker, Floyd B.; Storms, Edmund K.; Holley, Charles E. Jr. (Los Alamos Scientific Lab., N. Mex.). J. Chem. Eng. Data; 14: 244-6(Apr 1969). (LA-DC-9769).

Zirconium carbides with carbon-zirconium ratios varying from 0.63 to 0.98 were burned in an oxygen bomb calorimeter. The enthalpy of formation of $ZrC_{1.0}$ was found by extrapolation to be $\Delta H^0_{f\,298°K} = -49.5 \pm 0.6$ kcal per mole from the equation $-\Delta H^0_{f\,298°K} = -7.4 \pm 1.3 + (84.1 \pm 3.3)x - (27.2 \pm 2.0)x^2$, where x is the carbon-zirconium ratio. (auth)

755 TRANSPARENT POLYCRYSTALLINE BERYLLIA. (to Nippon Gaishi Kabushiki Kaisha). British Patent 1,209,780. 21 Oct 1970. Priority date 22 Mar 1967, Japan.

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A transparent BeO containing 0.01 to 1.0 wt % of at least one colorless oxide is described. The colorless compound is the oxide of Li, Mg, Al, Si, Ca, Ti, Sr, Y, Zr, Mo, La, or Th. The polycrystalline compacted BeO body containing the additive is sintered at 1000 to 1500°C in air and at 1400 to 1900° in vacuum. (J.R.D.)

756 SILICON CONTAINING REFRACTORY CONSTRUCTION MATERIALS. Gugel, E. Sprechsaal Keram. Glas Email Silikate; 103: 288-96(Apr 1970). (In German).

A survey is presented of the properties of SiC as concerns chemical stability, oxidation, binding agents, properties of bound SiC, and application fields. In the reactor technology the especially dense self-bound SiC is used because of its good radiation stability, its high strength, its small surface, and its high chemical stability. (INIS)

757 STUDY OF FRACTURE TOUGHNESS OF PLATES OF WC–Co CERMETS BY BENDING METHOD. Coster, Michel; Chermant, Jean-Louis; Deschanvres, Alfred (Caen Univ., France). Compt. Rend., Ser. C; 271: 446-9(17 Aug 1970). (In French).

Annealed cermets containing 10 to 20 percent in weight of Co and with a mean diameter d between 2 and 8 μ were studied. The fracture probability for various grain-size distributions increased as a function of the crystal diameter. A critical fracture strength diameter corresponding to a fracture probability of 0.5 was defined for any given sample. Various studies indicated that the fracture strength was varying as a function of $d^{-\frac{1}{2}}$, in particular, when stresses are applied by matrix on crystals. The results obtained verified this law. (France)

758 ISOTOPE EFFECT FOR CATION SELF-DIFFUSION IN CoO CRYSTALS. Chen, W. K.; Peterson, N. L. (Argonne National Lab., Ill.). Radiat. Eff.; 4: 141-3(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Diffusion of ^{60}Co in CoO single crystals has been measured in the temperature range from 963 to 1638°C in air by the tracer-sectioning technique. The temperature dependence of the diffusion coefficient for ^{60}Co is given by the expression, $D = (5.0 \pm 0.4) \times 10^{-3} \exp(-38390 \pm 230/RT)$ cm^2/sec. The isotope effect for cation self-diffusion was determined by simultaneous diffussion of ^{55}Co and ^{60}Co tracers in CoO crystals. The strength of isotope effect defined by $E_{60} \equiv (1 - D_{60}/D_{55})/[(1 - (m_{55}/m_{60})^{\frac{1}{2}}] = f \cdot \Delta K$ was 0.582 ± 0.009 independent of temperature in the range from 1081 to 1411°C. By comparing the experimental value of E_{60} with the calculated values for the various possible diffusion mechanisms, it has been concluded that the cations diffuse by a vacancy mechanism in CoO, and the ΔK is 0.746. (auth)

759 THERMAL CONDUCTIVITY OF SOLID SOLUTIONS OF Si IN Fe AND Co. Krentsis, R. P.; Zinov'ev, V. E.; Andreeva, L. P.; Gel'd, P. V. (Ural Polytechnic Inst., Sverdlovsk, USSR). Fiz. Metal. Metalloved.; 29: 118-23(Jan 1970). (In Russian).

Results were obtained from temperature variations in solid solutions of these compounds. The thermal conductivity of pure cobalt in this temperature range was also measured. Using these data the coefficients of thermal conductivity of these compounds were calculated. Mechanisms of carry over and scattering in ferromagnetics were also studied. (J.R.D.)

760 SOME ELECTROPHYSICAL PROPERTIES OF DIBORIDES OF TITANIUM, ZIRCONIUM, AND HAFNIUM. Kovens'kaya, B. A. (Inst. of Problems in Material Studies, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 7, 661-3(Jul 1970). (In Ukrainian).

Some electrophysical properties of the diborides of titanium, zirconium, and hafnium were investigated in the temperature range of 293 to 1250°K. The electrotransport parameters are estimated in one-band approximation, and a correlation of the latter with the electronic structure of the mentioned diborides is established. (auth)

Structure and Phase Studies

Refer also to abstracts 116, 682, 683, and 688.

761 (AD–706221) IMPLEMENTATION OF ADVANCED TECHNOLOGY FOR CAST METALS. Final Report. Colligan, George A. (Dartmouth Coll., Hanover, N. H. Thayer School of Engineering). Mar 1970. Contract DAAG46-68-C-0048. 63p. (AMMRC-CR-70-9). NTIS.

Phase equilibrium studies in the system ZrO_2–MgO locate the eutectoid point at 13.7 mole % MgO at 1400°C. Disagreement in the literature as to the position of the eutectoid point can be attributed to the difficulty in the attainment of equilibrium or method of analysis. A model of the stabilization process based primarily upon entropy of mixing effects alone satisfactorily explains the relative positions of the tetragonal + cubic–cubic phase field boundaries observed experimentally in various binary zirconia systems. Commercially significant conclusions are drawn as a result of these studies with respect to the process variables, time, temperature, and stabilization compound addition and identity to derive the true benefits of high quality ZrO_2 refractory bodies. (auth) (USGRDR)

762 (AD–708476) PHASE EQUILIBRIA INVESTIGATION OF BINARY, TERNARY, AND HIGHER ORDER SYSTEMS. PART VIII. THE STRUCTURE OF A TERNARY PHASE T3C2 IN THE V–Ta–C SYSTEM. Rudy, Erwin (Aerojet-General Corp., Sacramento, Calif. Materials Research Lab.). Apr 1970. Contract F33615-67-C-1513. 21p. (AFML-TR-69-117(Pt.8)). NTIS.

The crystal structure of Ta_2VC_2 was determined from x-ray powder photographs. The phase is stable from room temperature to above 2600°C. The homogeneity range of 1650°C varies between the limits (Ta 1.80 to 2.04, V 1.20 to 0.96) C 1.74 to 1.80; the phase is thus substantially deficient in carbon. (USGRDR)

763 (CEA-CONF–1637) STUDY OF U–Pu–O SYSTEM. Dean, Guy; Boivineau, Jean Claude; Chereau, Pierre; Marcon, Jean Pierre (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 17p. (In French). (CONF-701001–13). Dep. CFSTI (U. S. Sales Only).

From 4th International Conference on Plutonium and Other Actinides, Santa Fe, N. Mex.

Substoichiometric compounds of ratios Pu/U + Pu > 40 at.% and O/U + Pu < 2.00, prepared by sintering under an H_2 atmosphere or under vacuum, were studied at room temperature and at high temperature. A moderate reduction by H_2 led to a two-phase system: one phase remained face-centered cubic and the other, face-centered cubic becoming rhombohedral with a composition close to M_7O_{12} for Pu concentrations around 60 at.% and a ratio O/U + Pu = 1.70. At high temperature, the two phases obtained for 1.80 < O/U + Pu < 1.96 were fcc in structure, one corresponding to the original fcc phase and the other to the rhombohedral phase. Examination of the thermodynamic quantities confirmed the nonideality of UO_2–PuO_2-z solid solutions and explained the disagreement observed on $\overline{\Delta G}_{(O2)}$ between calculations and the vapor pressure measurements carried out at high temperatures. The results obtained at 1373°K in the Pu-O system, for mixed oxides of ratio Pu/U + Pu = 10 and 15% showed a sudden change of slope in the curve $\overline{\Delta H}_{(O2)} = f(O/Pu)$ for a value O/U + Pu around 1.70. The following values were obtained for PuO_2: $\Delta H^0 f = -252.8$ kcal, $H_{1373} - H_{298} = 21.5$ kcal. (France)

764 (CONF–700403-(Vol.1), pp 115-26) MIXED CRYSTAL PHASES IN THE SYSTEM ThO_2–PrO_x. Brauer, G.; Willaredt, B. (Freiburg Univ. (West Germany). Chemisches Laboratorium).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

Praseodymia and thoria formed homogeneous crystalline phases when mixed and heated to 1300°C. The oxygen content of these phases depended on the pressure of molecular oxygen maintained during the cooling of the samples from 500°C down to room temperature. It is surprising that the admixing of thoria does not favor the uptake of oxygen to form more Pr(IV) compared with the case of pure praseodymia. The lattice constants of the mixed crystal series (Pr, Th)O_2 and (Pr, Th)O_{2-x} show appreciable deviations from Vegard's law. It is suggested to explain this by the ionic size effect. (auth)

765 (CONF-700403–(Vol.1), pp 140-51) ELECTRON-DIFFRACTION STUDIES ON THIN FILMS OF SAMARIUM SESQUIOXIDE. Boulesteix, C. (Paris Univ., Orsay (France). Institut d'Optique); Caro, P. E.; Gasgnier, M.; La Blanchetais, C. Henry (Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Terres Rares); Pardo, B. (Paris Univ., Orsay (France). Institut d'Optique).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Samarium metal thin films were oxidized to C–Sm_2O_3. By heating, C–Sm_2O_3 recrystallized into large crystals of B–Sm_2O_3. The crystals were all almost perpendicular to the [10$\bar{1}$] direction of the monoclinic B-type unit cell. The plane of the film was (20$\bar{1}$). The crystals exhibited twins with respect to the planes {111} and {313}. The (20$\bar{1}$) plane was the basal plane for the $(LnO)_4^{4+}$ packing of OLn_4 tetrahedra in B-type Ln_2O_3 which was a slight deformation of A-type Ln_2O_3. Twinning was easily explained on the basis of the close connection to A–Ln_2O_3. (auth)

766 (CONF-700403–(Vol.1), pp 181-92) PSEUDOPHASE BEHAVIOR IN THE EPSILON AND IOTA REGIONS OF THE

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PRASEODYMIUM OXIDE–OXYGEN SYSTEM. Turcotte, R. P.; Jenkins, M. S.; Eyring, L. (Arizona State Univ., Tempe. Dept. of Chemistry).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Besides line and nonstoichiometric phases complex oxide systems exhibit reproducible bivariant behavior, termed pseudophases, in the two-phase regions which leads to hysteresis. Two of these pseudophases in the praseodymium oxide-oxygen system are examined in detail by tensimetric and high temperature x-ray studies. The tensimetric measurements show marked and progressive shifting of the curves away from stoichiometry with increasing pressure. In addition unusual reversals are seen to occur both in oxidation and reduction. X-ray diffraction patterns at temperature are seen to show systematic changes in line positions and line widths. These are analyzed and their implications discussed in terms of suggested structural changes. Similarities and relevance to other systems are discussed. (auth)

767 (CONF-700403-(Vol.1), pp 376-87) AN INVESTIGATION OF THE Eu–Eu_2O_3 SYSTEM AND THE EQUILIBRIA BETWEEN THE EUROPIUM OXIDES AND THE Eu–Pt SYSTEM, WITH RELATED STUDIES OF THE Sm–Sm_2O_3 AND THE Yb–Yb_2O_3 SYSTEMS. Bedford, R. G.; Catalano, E. (California Univ., Livermore. Lawrence Radiation Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The binary system Eu-Eu_2O_3 was examined in detail over the composition range EuO to Eu_2O_3 at 1500°C. Only one intermediate oxide phase, Eu_3O_4, was found. Both EuO and Eu_3O_4 exhibit very narrow composition limits, while the monoclinic sesquioxide is stable over the composition range $EuO_{1.46}$ to $EuO_{1.50}$ at 1500°C. The melting points found for the three phases were 1900°C for EuO, 2000°C for Eu_3O_4, and 2300°C for Eu_2O_3. Europium was quantitatively extracted from EuO by reaction with Pt in sealed capsules at 1500°C, which resulted in the formation of an intermetallic phase plus a higher oxide of Eu. The most Eu-rich intermetallic phase found in these studies, $EuPt_{2+x}$, has the $MgCu_2$ structure and is stable over the composition range $EuPt_{2.0}$ to $EuPt_{2.8}$ at 1500°C. There may be one additional phase besides the previously reported $EuPt_5$ at Pt-Eu ratios above 3:1. No crystalline phases other than the sesquioxides were found in the Sm-Sm_2O_3 or the Yb-Yb_2O_3 systems. (auth)

768 CRYSTAL STRUCTURES OF Th_2CrN_3, Th_2MnN_3, U_2CrN_3, AND U_2MnN_3. Benz, Robert (Los Alamos Scientific Lab., N. Mex.); Zachariasen, W. H. J. Nucl. Mater.; 37: 109-13(Oct 1970).

The compounds Th_2CrN_3, Th_2MnN_3, U_2CrN_3, and U_2MnN_3 were prepared and their crystal structures determined. (G.M.C.)

769 QUANTITATIVE STUDY OF THE TEXTURES DEVELOPED IN ZIRCONIUM OXIDE PRODUCED BY POLYCRYSTALLINE ZIRCONIUM OXIDATION AT 850°C. Boisot, Pierre; Beranger, Gerard; Penelle, Richard (Ecole Nationale Superieure des Mines, Paris). Compt. Rend., Ser. C; 271: 257-60(27 Jul 1970). (In French).

Preferential orientations developed in zirconium oxide during polycrystalline zirconium oxidation at 850°C in pure oxygen atmosphere were determined by x-ray diffraction with the method of the inverse pole projections. The existence of three stable components as a function of the oxidation time was pointed out: (104) [1,0,1,0] (213) [538] and (102) [205]. (auth) (France)

770 HYDRIDES VERSUS FLUORIDES: STRUCTURAL COMPARISONS. Messer, C. E. (Tufts Univ., Medford, Mass.). Contract AT(30-1)-1355. J. Solid State Chem.; 2: 144-55 (Aug 1970).

The closeness of the ionic radii of the hydride and fluoride ions results in close structural analogies between the corresponding binary and ternary compounds of the highly electronegative elements. The analogies are closest for the alkalis, the alkaline earths, and aluminum. For the binary lanthanide and actinide compounds, the structures are related, but modified for the hydrides by the nonstoichiometry. The relative difficulty so far encountered in attempts to prepare ternary hydrides involving these elements is probably also due to nonstoichiometry. For the transition metals, the hydride and fluoride structural patterns differ considerably, the metallic nature of the hydrides here being involved as well. On the basis of these analogies, the known structures of corresponding hydrides and fluorides are correlated and the possible new ternary hydride compounds may be predicted. (auth)

771 THERMOGRAPHIC AND X-RAY STRUCTURAL STUDY OF THE SYSTEM UCl_4–KCl–NaCl. Martynova, N. S.; Vasil'kova, I. V.; Susarev, M. P.; Tolkachev, S. S. This paper was summarized in At. Energ. (USSR); 25: 316-17(Oct 1968) as paper No. 235. (In Russian).

The results of thermographic and x-ray diffraction studies of the systems UCl_4–NaCl, K_2UCl_6–NaCl, and UCl_4–KCl–NaCl are given. (G.M.C.)

772 CRYSTALLINE STRUCTURES OF USb_3O_{10} AND $USbO_5$ IN ACRYLONITRILE CATALYSTS. Grasselli, Robert K. (Standard Oil Co., Cleveland); Suresh, Dev D.; Knox, Kerro. J. Catal.; 18: 356-8(Sep 1970).

The existence of two new U–Sb–O crystalline phases, USb_3O_{10} and $USbO_5$ is discussed. The structures are pseudohexagonal and the superstructure is orthorhombic. The heavy atoms in the second compound lie at positions close to those in the first compound, but with a distortion of all atoms leading to a lower symmetry subgroup. (M.C.G.)

773 SOME FACE-CENTERED-CUBIC MIXED RARE-EARTH DICARBIDES. Adachi, G.; Kotani, H.; Yoshida, N.; Shiokawa, J. (Osaka Univ.). J. Less-Common Metals; 22: 516-17(Dec 1970).

Double dicarbides containing two rare earth ions of very different radii were found to be fcc at the mole ratio of 1:1. The cubic unit cell of 1:1 LaC_2–YC_2 was determined to be a = 5.75 Å; in the other regions, the body-centered tetragonal structure was formed. Fcc phases were also formed in La–Dy–C (a = 5.72 Å) and Pr–Lu–C (a = 5.62 Å). The limit of the ionic radius difference for the formation of a fcc phase is ~14%. (D.L.C.)

774 CRYSTAL STRUCTURE OF THORIUM CARBOHYDRIDES. PART II. HEXAGONAL THORIUM CARBOHYDRIDE. Makovec, M.; Ban, Z. (Inst. Rudjer Boskovic, Zagreb. Inst. for Inorganic and Analytical Chemistry, Zagreb). J. Less-Common Metals; 22: 383-8(Dec 1970).

The cubic thorium carbohydride (deuteride) was found to transform irreversibly into the hexagonal modification on heating above 380°C. This phase corresponds to the known ternary carbohydride. The arrangement of light atoms has been determined by means of NMR and neutron diffraction methods. X-ray powder diffraction was used to determine the position of the thorium atoms. The positions of the aforementioned atoms in the space group $P\bar{3}m1$ are: 2 Th in 2(d): ±⅓, ⅔, 0.255, 1 C is probably statistically distributed over positions 1(a) and 1(b) 000 and 001/2 in certain proportions, and 2H in 2(d): ±⅓, ⅔, 0.645. The mean R value for the carbohydride amounts to 14.6% if only the 000 positions are occupied and to 16.2% for both 000 and 001/2 positions. NMR results indicate the possibility of the existence of H_2 pairs, but this could not be confirmed by neutron diffraction. (auth)

Radiation Effects

Refer also to abstracts 705 and 1888.

775 (BNWL-1349-2, pp 3.1-55) IRRADIATION BEHAVIOR OF FAST REACTOR FUEL MATERIALS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

The high heat fluxes and large fuel-clad gaps characteristic of FTR fuel pins result in large calculated temperature drops across the fuel-clad interface. Three capsules were designed to study the rate of fuel-clad gap closure and associated change in ΔT. Postirradiation examination of the first capsule was completed. Measurements of residual fuel-clad gap width show approximately half of the initial 0.011 in. diametral gaps were filled by radial displacement of the fuel. The second capsule has been assembled and we will study the effects of several thermal cycles at startup on the fuel-clad gap and associated ΔT. Capsule hardware for the instrumented capsule was fabricated, and cored fuel pellets are being fabricated. Four capsules were assembled for irradiation in the SNOUT facility to study the effects of O/M on the melting heat rating of UO_2–25 wt % PuO_2 fuel. The tests are intended principally to duplicate earlier experiments which showed melting heat rating to be only slightly sensitive to O/M from $1.94 \leq O/M \leq 2.00$. The design of an irradiation test to determine the effect of burnup on the melting heat rating is 80% complete. Calculations confirm that melting can be obtained under projected test conditions. Availability of high burnup fuel will be the critical item in completing the test. Postirradiation examination continues on stainless steel-clad, mixed-oxide fuel pins of several different stoichiometries that have been irradiated to burnups estimated as high as 160,000 MWd/Mtm. Observations on metallographic specimens from fuel pin BNW 1–2 have revealed a two-

phase material filling the central void at two locations near the lower end of the fuel pin. A large metallic fission product ingot has also been found in the central void at each of these locations. The two phases consist of fuel and an as-yet unidentified $\beta-\gamma$ emitter. One of the phases penetrates fuel cracks, leading from the central void to the fuel cladding interface, to a depth of approximately one-half the fuel radius. The two-phase regions are at locations corresponding to the axial positions indicated by gamma ray spectral analysis as having a high concentration of niobium fission product. It is uncertain whether the niobium is present as the ingot or as one of the two phases. To attain data necessary for fuel pin design criteria, an analysis has been performed of data on cladding thickness loss resulting from fuel-fission product-cladding reaction in a stainless steel, mixed-oxide fuel system. The cladding thickness loss normalized to fuel burnup was plotted as a function of cladding inside surface temperature. The upper limit of the cladding thickness loss can be expressed empirically as thickness loss (in.) = 7.175×10^{-11} [T(°F) – 700] [BU] where T = temperature of the cladding inside surface BU = fuel burnup in MWd/Mtm. Procedures were established for preparation and replication of polished surfaces of irradiated mixed-oxide specimens. Scanning electron microscope examination of the replicas provides for detailed evaluation of individual voids on grain boundaries. A model was derived (based on nonequilibrium thermodynamics) which describes thermal diffusion in two component oxide systems. The form of the flux equation is compared with an empirically derived diffusion flux equation. (auth)

776 (BNWL-1349-2, pp 6.1-16) FAST REACTOR ABSORBER MATERIALS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

Irradiated boron carbide from the second Hanford discharge (21×10^{20} captures/cm^3 maximum) was examined to characterize the fragmentation of hot-pressed pellets as a function of original density. Radial cracks were observed in low density pellets and circumferential cracks in high density pellets. Pellets of 65% TD fractured into small, irregularly-shaped pieces and generated much fine material. The fractures of 90% TD pellets tended to form shells or annular rings of B_4C and generated less fine material. The fracture habit of 99% TD pellets was extremely shell-like. The compatibility of irradiated B_4C pellets with sodium at 500°C was examined in a 1000-hr test. The 90% TD pellet broke into fragments and powder and the 99% TD pellet broke into two pieces and showed extensive cracking along grain boundaries. Samples from a B_4C Type 316 SS compatibility study were sectioned and examined metallographically. The reaction zone was about 4.2 μ thick after 3250 hr at 600°C. The irradiation of boron carbide at 500 to 1200°F in Hanford thermal reactors was completed. The 65% and 80% TD pellets do not appear to vary significantly in their gas release behavior, but both release a higher gas fraction than the 99% TD pellets. The percent of gas released from boron carbide appears to increase rapidly when the irradiation temperature exceeds 1000°F. Postirradiation measurements were completed for tantalum samples irradiated in EBR-II at 1175 to 2100°F. Samples irradiated at the lower temperatures exhibited the greatest swelling. There was no indication of interaction between the silicon carbide temperature monitor and the tantalum holder. Construction of a test capsule was completed to irradiate boron carbide and tantalum samples in a filtered ETR flux. Gas release will be monitored during the irradiation which will begin with Cycle 108 in early July and continue for two cycles. (auth)

777 (BNWL-1349-2, pp 7.1-3) NUCLEAR GRAPHITE. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

From Reactor fuels and materials development programs for Fuels and Materials Branch of USAEC Division of Reactor Development.

Irradiation tests at temperatures of 500 to 1300°C are now underway on samples which have previously been irradiated at temperatures below 500°C to a fluence of about 10^{20} nvt (E > 0.18 MeV). This irradiation is designed to test the extent of a cold seeding postulate. The first discharge of the capsules to investigate irradiation creep in graphite was accomplished. The creep capsules functioned properly. Sample dimensions, thermal expansion, and elastic modulus were measured on samples which have received a dose of about 1.1×10^{21} nvt (E > 0.18 MeV). The yield of CO from the radiolysis of a mixture of CO_2 and H_2 in He carrier was determined. At 80°C when the H_2 and CO_2 concentrations are below 1000 ppM, the 100 eV yield can be expressed by $1/G(CO) = 39.0/C + 0.526$ where C is the concentration of CO_2 in parts per million. (auth)

778 (CEA-CONF-1636) ANELASTIC PROPERTIES OF GRAPHITES IRRADIATED AT ROOM TEMPERATURE. Rouby, D.; Gobin, P.; Schill, R.; Rappeneau, J. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). 1970. 17p. (In French). (CONF-700624-2). Dep. NTIS (U. S. Sales Only).

From Conference on Anelastic Effects due to Defects and Phase Transformations in Solids, Lausanne, Switzerland.

A study of the internal friction of a quasi-monocrystalline graphite very slightly irradiated (dose equal to 5×10^{16} n/cm^2) revealed two populations of irradiation induced defects: one is formed by interstitials blocked in the lattice by the presence of an atom in Wallace position. These interstitials are reoriented at about 300°K with the appearance of peak P_3 (relaxation peak in the curve representing the internal absorption variation as a function of temperature); the other consists of highly mobile simple interstitials in the conventional configuration which migrate towards dislocations where they form accumulations of several atoms. This leads to strong bonds able to trap dislocations by conversion into Wallace type accumulations. The detrapping of dislocations under the effect of applied stresses causes the appearance of "peak P_4" in the variation curve mentioned above. The reduction of peak P_4 as a function of dose or annealing can be ascribed to the enlargement of accumulations on the dislocation lines. The anchoring would then be more efficient. (auth) (France)

779 (DP-Report-316) REVIEW OF IRRADIATION RESULTS OF DRAGON COATED PARTICLE FUEL. Project DRAGON. Coobs, J. H.; Hauser, G. P.; Vivante, C. (Atomic Energy Establishment, Winfrith (England)). Jan 1965. 51p. (CONF-641031-1). Dep. NTIS.

From Symposium on Basic Research, Harwell, Eng.

Results of tests on samples of fission product-retaining fuels in the course of Dragon fuel irradiation program are presented. The physical behavior and fission product emission characteristics of coated particle fuels are reviewed. Conditions of irradiation and test results are given which have led to tentative conclusions about the behavior of coated particle fuels. (auth)

780 (GA-10268) RESEARCH ON GRAPHITE. Quarterly Progress Report for the Period Ending August 14, 1970. Engle, G. B.; Price, R. J.; Bokros, J. C. (Gulf General Atomic, Inc., San Diego, Calif.). 13 Aug 1970. Contract AT(04-3)-167. 14p. Dep. NTIS.

A series of previously irradiated graphites and a number of new isotropic materials were organized to study the effect of crystallite size, crystallite orientation, and density on dimensional and property changes. Dimensional changes from a portion of the specimens irradiated in capsule GE-H-13-17 are reported. Experiments to study the temperature-history effects on dimensional changes, the behavior of highly oriented graphites, and the changes in thermal conductivity are outlined. In these experiments both previously irradiated materials and new materials have been included. A series of experiments was initiated to study the effect of coke structure on irradiation behavior. Fine-structured isotropic cokes, heated at 2600 to 2800°C, are being emphasized in these studies. During the past 3 years, specimens have been irradiated in the Dragon reactor to measure radioinduced creep in a number of graphites. These specimens are awaiting measurement at RCN, Petten, Holland. (auth)

781 (ORNL-tr-2387) MECHANISMS OF DENSIFICATION OF THE MIXED OXIDE UO_2–PuO_2 DURING IRRADIATION EFFECTS ON FISSION GAS RELEASE. Mikailoff, Hubert; Bloch, Jacqueline; Conte, Madeleine (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). Translated for Oak Ridge National Lab., Tenn., from report CEA-Note-N-1254. 27p. Dep. NTIS.

An abstract of this paper, prepared from the original language, appeared as NSA 24: 36995.

782 (WAPD-TM-980) REVIEW OF MECHANISMS FOR SWELLING AND GAS RELEASE OF OXIDE FUEL RODS. (LWBR Development Program). Nichols, F. A.; Warner, H. R. (Bettis Atomic Power Lab., Pittsburgh, Pa.). Oct 1970. Contract AT(11-1)-Gen-14. 28p. Dep. NTIS.

Major disagreements exist concerning the dominant mechanisms for the release of fission gases from operating ceramic fuel elements. The multiplicity of phenomena occurring simultaneously, coupled with a dearth of gas release data reflecting accurate knowledge of the time-temperature history of the elements, makes the task of defining quantitatively the relative importance of specific mechanisms extremely difficult. Except for low temperatures, where relatively small amounts of gas are released, probably by recoil and knockout mechanisms, there are two principal schools of thought on operative mechanisms; the

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"bubble migration" concept and the "bubble re-solution" concept. Pertinent theory and data are critically reviewed and shown to indicate a strong importance of bubble migration at the higher temperatures (≥ 1200°C in UO_2), with re-solution effects becoming relatively more important at lower temperatures. A comprehensive view of fission-gas swelling and gas-release mechanisms covering the full temperature range and believed to be consistent with available data is developed. (auth)

783 IRRADIATION BEHAVIOR OF THE MIXED OXIDE FUELS. 1. Kobayashi, Shigeo; Matsumoto, Kenichi (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Genshiryoku Kogyo; 16: No. 3, 78-83(Mar 1970). (In Japanese).

Mixed uranium and plutonium oxide fuel is mainly employed in Na-cooled fast breeder reactors either in operation or being planned. More irradiation tests are required of the fuel than of those for thermal reactors, because of the necessary high specific power and burnup. To correlate the phases of the mixed fuel it is important to know the irradiation behavior. Phases in the Pu–O and the U–Pu–O systems are described. It is noted that thermal conductivity of the fuel is influenced by density, composition, and by irradiation. Thermal conductivity, expansion, and gap are described. Mechanical properties are important because thermal stress and swelling have a relation with the cladding. Breaking strength, elasticity, and creep are described. (Japan)

784 DOSIMETRIC USE OF BERYLLIUM OXIDE AS A THERMOLUMINESCENT MATERIAL: A PRELIMINARY STUDY. Scarpa, G. (Hammersmith Hospital, London). Phys. Med. Biol.; 15: 667-72(Oct 1970).

The results of a preliminary study on the dosimetric characteristics of three different grades of commercial sintered beryllium oxide are reported. Among useful features of this promising thermoluminescent material a very low sensitivity to thermal neutrons (0.2 γ-rads equivalent per 10^{10} neutrons cm^{-2}), a fairly high sensitivity to γ-rays, and a good energy response, are emphasized. These properties enable beryllium oxide to be used successfully in mixed fields of thermal neutrons and γ-rays, such as exist in nuclear reactor facilities. (auth) (UK)

785 DIMENSIONAL CHANGES IN UO_2–SiO_2 VITROCERAMICS DURING IRRADIATION. Lungu, S.; Rybko, L. (Inst. for Atomic Physics, Bucharest). Radiat. Eff.; 5: 173-82(Oct 1970).

The evolution of the dimensional changes of UO_2-SiO_2 vitroceramics with a content of 60–70 per cent mol UO_2 during irradiation at a low fission rate is presented. The experimentally obtained curves are extremely well represented by the expression $(\Delta l/\Delta l_\infty) = (2/\pi)\text{arc tg}(\phi/\phi_0)$ where Δl and Δl_∞ are the current and saturation length change respectively, ϕ the integrated flux, and ϕ_0 a constant with the same dimensions. The experimental data are analyzed taking into consideration the irradiation compaction of the silica glass phase and glass phase flow as caused by the interphase stresses. (auth)

Plastics and Other Materials

Refer also to abstracts 73 and 156.

786 (N-70-32499) PROTON AND ELECTRON EFFECTS IN THERMAL CONTROL MATERIALS. Final Report. Fogdall, Lawrence B.; Cannaday, Sheridan S. (Boeing Co., Seattle, Wash. Aerospace Group). May 1970. Contract NAS5-11219. 96p. (NASA-CR-110715). NTIS.

The effects of 35 keV electrons and 40 keV protons on the reflectance and degradation properties of selected specular and diffuse thermal control materials tested at room temperatures were studied and compared. FEP Teflon, Alzak, Kapton, and diffuse white paints were emphasized. Reflectance measurements between 0.24 and 2.54 microns wavelength were made on test specimens at various exposure levels. Plots of reflectance properties of the materials as a function of wavelength were obtained by computer processing of test data, and the results are presented. Comparison of the proton and electron exposure results shows four different types of spectral reflectance degradation characteristics in the 18 types of materials tested in both particle environments. Plots showing the damage classifications are included, and coatings offering best solar absorptance stability are identified. A coating temperature study, a proton energy study, combined particle-ultraviolet radiation studies, and in situ capability for coating emittance measurements following exposure to charged particles are recommended for future effort and understanding. (auth) (STAR)

787 RHEOLOGICAL MEASUREMENTS ON IRRADIATED POLYETHYLENE. Ivaldi, Carlo Mussa; Guglielmino, Paolo (Univ., Turin). Ric. Sci.; 39: 754-60(Oct-Dec 1969). (In Italian).

Four samples of polyethylene having absorbed increasing amounts of energy were subjected to rheological testing in a Weissenberg rheogoniometer in order to investigate the tangential and the normal stresses at different values of shear rate. (auth)

788 INFORMATION ON THE LIFE OF INSULATING SYSTEMS FOR ELECTRICAL PLANT IN POWER ENGINEERING. Lebok, F. (Minnesota Mining and Mfg. CO. mbH, Hamburg). Elektrotech. Z., B; 22: No. 4, 63-8(1970). (In German).

The long-term behavior of insulating materials (mainly their mechanical properties such as brittleness, elongation, yield strength) is compared for various doses of neutron and γ-irradiation. (INIS)

789 LUBRICATION OIL FOR ATOMIC POWER GENERATION. 2. Shinozaki, Sadayuki; Iwanaga, Yoshihiro (Idemitsu Kosan Co. Ltd., Tokyo). Sekiyu To Sekiyu Kagaku; 14: No. 3, 86-93(Mar 1970). (In Japanese).

Among nuclear radiations, gamma radiation is the most important in connection with lubricating oils. Gamma radiation which can penetrate considerable thickness, causes severing of the coupled radicals of organic compounds, reduces viscosity and releases gases, then the viscosity is increased by the polymerization of radicals. The deterioration by gamma radiation of turbine oils with additives, gear oil, high-viscosity-index oil, and grease was studied under the following conditions: ^{60}Co gamma source; irradiation, 10^6R/hr; and oil temperature, ordinary. The results of these irradiation tests are reported. On the whole, except for high-viscosity-index oil, no deterioration of the oil and grease occurred up to 10^7 R. Therefore, the lubricating oil generally used for nuclear machinery presents no problem, as far as the radiation deterioration is concerned. But it is necessary to replace the oil every year or two because of the deterioration due to actual operating conditions, such as temperature, mechanical friction, and wear. (Japan)

790 RADIATION STABILITY OF SERPENTINE CONCRETE. Dubrovskii, V. B.; Ibragimov, Sh. Sh.; Ladygin, A. Ya.; Kulakovskii, M. Ya.; Pergamenshchik, B. K. This paper was summarized in At. Energ. (USSR); 25: 515(Dec 1968) as paper No. 246. (In Russian).

The use of serpentine concrete and the mineral serpentine for reactor radiation shielding has been restricted to date because of the lack of data on the radiation stability of these materials. The present article cites test results of specimens of serpentine and serpentine concrete on Portland cement after irradiation by an integrated neutron flux of 10^{20} to 1.7×10^{21} neutrons/cm^2. No changes were detected in the characteristics of the irradiated serpentine specimens as compared to control hot specimens: the geometric dimensions and the shape (relative error in measurements 0.5%); water content; thermal conductivity (thermal conductivity at 100°C was 0.99 to 1.12 kcal/m·hr·°C); linear thermal expansion coefficient [in temperature range 100 to 300°C, it was (6 to 7) × 10^{-6} deg^{-1}]; compressive strength and strain modulus. As a result of the exposure, serpentine concrete expanded: its density declined. The maximum linear expansion of 1.3 to 1.7% was reported at a dose of (1.3 to 1.7) × 10^{21} neutrons/cm^2. The expansion of the concrete obviously occurs because of the formation of microcracks traceable to the difference under irradiation of radiation-induced deformations in cement stone, serpentine, chemical compounds of finely ground serpentine, and Portland cement. The strength of the serpentine concrete varies inversely with exposure dose, and is 40% initially at a dose of (1.3 to 1.7) × 10^{21} neutrons/cm^2. The strain modulus varies in the same manner as the strength. The fall-off in thermal conductivity 13% at maximum exposure dose, is accounted for principally by the increased porosity of the concrete as a result of microcracks forming. The linear thermal expansion coefficient in irradiated and control specimens of serpentine concrete was the same (6 to 7) × 10^{-6} deg^{-1}, in repeated heating tests. Exposure to doses up to 1.7×10^{21} neutrons/cm^2 failed to change the water content of the concrete. Serpentine concrete is usable as a shielding and structural material at integrated neutron fluxes to 1.7×10^{21} neutrons/cm^2 and temperatures to 350°C, while a flux of high-energy neutrons of energy greater than 10 to 50 keV may amount to (1.2 to 1.4) × 10^{21} neutrons/cm^2 (the water content in the concrete depends solely on the temperature; the amount of material per unit shielding area hardly varies at all as the concrete expands; the residual strength of 40% is entirely sufficient to absorb external loads, temperature and radiation stresses). In shielding design and calculations, provision should be made for variations in the characteristics of serpentine concrete at high integrated neutron flux levels. The characteristics of the mineral

serpentine after irradiation by an integrated neutron flux of 1.3×10^{21} neutrons/cm^2 show no change. A possible 0.5% linear expansion of the serpentine should be considered when it is used in shielding structures (as fill in the tank, etc.). (auth)

791 METHOD AND APPARATUS FOR FISSION FRAGMENT IRRADIATION. Johnston, Robert B.; Porter, Charles R.; Wilson, Dennis W. (to General Electric Co.). U. S. Patent 3,529,157. 15 Sep 1970. Filed 11 Aug 1966.

A method and apparatus are described for continuously irradiating a strip of dielectric material with fission fragments. In a typical embodiment, a tape of a dielectric material is passed adjacent a sheet of fissionable material which is bombarded with neutrons to cause the emission of fission fragments from the fissionable material. The fission fragments are collimated and impinge on the tape, forming damage tracks. The irradiated strip is suitable for treatment in an etchant which removes material along the damage tracks formed by the fission fragments. These strips are then ready for use as membrane filters. (auth)

792 VAPORISATION OF PYROLYTIC GRAPHITE. Zavitsanos, P. D. pp 1-13 of Dynamic Mass Spectrometry. Vol. 1. /Price, D. (ed.). Salford, Eng.; Heyden and Sons Ltd. (1969).

From 2nd European Symposium on the Time-of-Flight Mass Spectrometer, Salford, England. See CONF-690723.

Pyrolytic graphite was studied to measure the gross rate of sublimation, the composition of the resulting vapor and partial pressures of the resulting species and the vaporization coefficients for the gaseous carbon species so that composition of the boundary layers could be predicted more accurately for nonequilibrium conditions. The vaporization was studied by using the Knudsen effusion target method with a recording microbalance. Rates of sublimation were measured by heating cylinders of pyrolytic graphite in vacuum by electron bombardment. The vapor was analyzed as a function of temperature under conditions of equilibrium and nonequilibrium using a Bendix time-of-flight mass spectrometer. The results are tabulated. (UK)

793 ACCELERATOR IRRADIATIONS OF MINERALS: IMPLICATIONS FOR TRACK FORMATION MECHANISMS AND FOR STUDIES OF LUNAR AND METEORITIC MATERIALS. Seitz, M. (Washington Univ., St. Louis); Wittels, M. C.; Maurette, M.; Walker, R. M.; Heckman, H. Radiat. Eff.; 5: 143-8 (Oct 1970).

Natural crystals of feldspars, pyroxenes, quartz, and apatite have been irradiated in the Berkeley HILAC with neon and argon ions of up to 10.2 MeV/amu with maximum doses of 1.6×10^{13} argon ions/cm^2 and 4.0×10^{13} neon ions/cm^2 respectively. The samples were thinned to thicknesses near 30 microns, stacked to form the target, and then bathed completely in the ion beams. X-ray and optical observations revealed: (a) a crystal distortion and curvature with the argon irradiation similar to that produced in mica; (b) a lesser effect from neon bombardment; (c) a fracturing of the crystal samples which depended on the total dose and energy of the incident ion; (d) polygonized structures produced when either neon or argon ions (with sufficiently high concentration) were trapped within the crystals. The interpretation of the measurements, their correlation with the mechanism of track formation, and implications concerning the alteration of the lunar surface due to solar particles and the exposure of lunar and meteoritic material in the ancient solar flare cosmic rays are discussed. (auth)

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PHYSICS (GENERAL)

Astrophysics and Cosmology

Refer also to abstract 1429.

Cosmic Ray Exposure Ages

Refer also to abstracts 949, 953, 955–957, and 1264.

794 VANADIUM ISOTOPIC COMPOSITION AND CONTENTS IN CHONDRITES. Pelly, I. Z. (Purdue Univ., Lafayette, Ind.); Lipschutz, M. E.; Balsiger, H. Geochim. Cosmochim. Acta; 34: 1033-6(Sep 1970).

Vanadium isotopic ratios for terrestrial samples and chondrites of 8 different chemical-petrologic types are the same within the error limits thus indicating no significant difference in irradiation histories. Determinations of vanadium yield similar concentrations in unequilibrated and equilibrated ordinary chondrites. (auth) (UK)

795 EVIDENCE FOR DECAY OF EXTINCT ^{244}Pu AND ^{129}I IN THE KAPOETA METEORITE. Rowe, M. W. (Texas A and M Univ., College Station). Geochim. Cosmochim. Acta; 34: 1019-28(Sep 1970).

Evidence for the decay of extinct ^{244}Pu and ^{129}I was found in the Kapoeta howardite. Accurate estimates of the amount of ^{136}Xe ($10.6 \pm 1.3 \times 10^{-12}$ cm^3/g) from ^{244}Pu fission decay and of the ^{129}Xe ($4.1 \pm 0.6 \times 10^{-12}$ cm^3/g) from ^{129}I beta decay are presented. The fission xenon yield in Kapoeta is ^{131}Xe : ^{132}Xe : ^{134}Xe : ^{136}Xe = $26 \pm 3.88 \pm 4.91 \pm 5. \equiv 100$, in agreement with yields previously reported by other workers on other meteorites. (auth) (UK)

796 SCHENECTADY METEORITE. Fleischer, R. L. (General Electric Research and Development Center, Schenectady, N. Y.); Lifshin, E.; Price, P. B.; (and others). Icarus; 12: 402-6(May 1970).

The fourth meteorite recovery in the United States during the past decade (and only the second since 1961) occurred in April 14, 1968, in Glenville, New York (a suburb of Schenectady). The exterior of the single stone of mass 283.3 gm consists primarily of a dull, black fusion crust, plus a fracture surface that was apparently produced by breakup in the atmosphere. Measurements of the densities of cosmic-ray tracks in olivine and pyroxene crystals at four positions in the meteorite, together with measured cosmic-ray exposure time of 31 million years, are evidence that the specimen came from a depth between 4 and 9 cm in a pre-atmospheric body of greater than 20-cm radius. The U–^{4}He and the K–^{40}Ar ages, 4.1×10^9 and 4.35×10^9 years, respectively, indicate that the meteorite underwent very little heating in space. (auth)

797 Ni, Ga, Ge, AND Ir IN THE METAL OF IRON-METEORITES-WITH-SILICATE-INCLUSIONS. Wasson, John T. (Univ. of California, Los Angeles). Geochim. Cosmochim. Acta; 34: 957-64(Sep 1970).

Neutron-activation determined concentrations of Ni, Ga, Ge, and Ir in the metal of 19 iron meteorites with silicate inclusions are in good agreement with the classification of Bunch, Keil, and Olsen (1970), which is based mainly on the mineralogy and texture of the inclusions. Odessa-type and Copiapo-type irons with silicate inclusions are found to be very closely related to each other, and to other members of chemical group I of the iron meteorites. Kendall County is probably related to these irons. Elga is a new Weekeroo Station-type iron with silicate inclusion, and Netschaëvo is closely related to these objects. Tucson is unique. Odessa-type and Copiapo-type meteorites appear to have formed nonigneously, whereas shock mixing and associated differentiation of silicates appears to have been a late step in the history of the Weekeroo Station-type irons. (auth) (UK)

Stars

Refer also to abstracts 972 and 1473.

798 HYDROSTATIC EQUILIBRIUM OF HYPOTHETICAL QUARK STARS. Itoh, Naoki (Kyoto Univ.). Progr. Theor. Phys. (Kyoto); 44: 291-2(Jul 1970).

Ivanenko and Kurdgelaidze (1969) suggested the existence of a quarkian core in the interior of hypothetical super stars of very large mass. The hydrostatic equilibrium of quark stars is investigated here by the method of Oppenheimer and Volkoff (1939), assuming the conventional quark model. Interactions between quarks are neglected. (W.D.M.)

799 HIGH-RESOLUTION SOLAR IMAGES AT 10 MICRONS: SUNSPOT DETAILS AND PHOTOMETRY. Turon, P. J.; Lena, P. J. (Observatoire, Meudon, France. Paris Univ.). Solar Phys.; 14: 112-24(Sep 1970).

A slow raster scanning device and a germanium bolometer were used to record two-dimensional photometric information in the 9 to 12-μ region; the results can be displayed on a CRT to get real 10 μ photographs of the upper photosphere ($\tau_{5000} \simeq 0.1$) with a spatial resolution of 2 arc sec. Comparison with simultaneously obtained visible CRT photographs showed a significant improvement of atmospheric seeing at long wavelengths. Bright, small (unresolved?) points were observed around sunspots at 10 μ and may be related to the so-called "moustaches" observed in the wings of strong lines. Umbral intensities are derived from the data and compared to various sunspot models. (auth)

800 CONTRIBUTIONS TO THE INTERPRETATION OF THE LIGHT CURVES OF THE CLOSE BINARY SYSTEMS. V. THE THEORETICAL LIGHT CURVE AND THE METHOD OF ELEMENT DETERMINATION. Ureche, Vasile (Cluj Univ.). Stud. Cercet. Astron.; 15: No. 1, 9-16(1970).

Using the results of previous papers the necessary formulae for the computation of the theoretical light curves of the close binary systems are developed. The explicit form of the "difference functions" $D_k^j(x)$, defined earlier, is given. Also, the method of element determination is given. This method is reduced to the method of differential corrections. For the condition equations, the corresponding weights are indicated. The results obtained are useful for the determination of the elements of a close binary system. (auth)

801 APPROXIMATING FUNCTIONS FOR ECLIPSING BINARY SOLUTIONS. Minti, Hari (Astronomical Observatory, Bucharest). Stud. Cercet. Astron.; 15: No. 1, 61-4(1970).

A complete program for the calculation of the Russell functions α^{oc} and α^{tr}, based upon the polynomial approximation functions, is given. Thus, the whole theoretical light curve is obtained if one performs such a program with both Fliegel and Wilson approximations (1968) and those proposed for the annular eclipse. (auth)

802 DETERMINATION OF THE CHARACTERISTICS OF THE ECLIPSING BINARY ϵ CORONAE AUSTRALIS. Dinescu, Rodica; Dumitrescu, Alexandru (Observatoire Astronomique, Bucharest). Stud. Cercet. Astron.; 15: No. 1, 65-71(1970). (In Rumanian).

The elements of the eclipsing binary ϵ Cr A of type W U Ma are calculated, using the photoelectric observations of S. Tapia at the Cerro Tololo Inter-American Observatory and reported earlier (Astron. J., 74: 533-7(May 1969)). (tr-auth)

803 RADIO NOVAE. Hjellming, R. M.; Wade, C. M. (National Radio Astronomy Observatory, Green Bank, West Va.). Astrophys. J.; 162: L1-4(Oct 1970).

Radio emission from two recent novae, Nova Delphini 1967 and Nova Serpentis 1970, was detected at wavelengths of 11.1, 3.7, and 1.95 cm. The results are consistent with the thermal radiation of expanding envelopes of ionized gas at high emission measures. (auth)

804 WATER ABSORPTION IN THE INFRARED SPECTRUM OF LONG-PERIOD VARIABLE STARS AND ASSOCIATED MICROWAVE EMISSION. Frogel, Jay A. (California Inst. of Tech., Pasadena. Carnegie Institution of Washington, D. C.). Astrophys. J.; 162: L5-9(Oct 1970).

Long-period Mira-type variables that have water emission at 1.35 cm are found also to have strong water absorption at 1.9 μ. The variation in the strengths of these two features are anti-correlated with one another. A possible physical model for this phenomenon is proposed, based on the concept of mass loss from late-type stars. (auth)

805 HIGHLY REDDENED R CORONAE BOREALIS STAR IN NGC 6231. Bessell, M. S.; Rodgers, A. W.; Eggen, O. J.; Hopper, P. B. (Australian National Univ., Canberra). Astrophys. J.; 162: L11-13(Oct 1970).

Recent B, V, R, and I observations of star 92 in NGC 6231 show that this star is extremely red in all colors and is also variable. Several spectra obtained indicate that NGC 6231-92 is an R Coronae Borealis star, and the unusual colors must therefore result from very heavy localized reddening. (auth)

806 NEAR-INFRARED SPECTRA OF NML CYGNI AND IRC + 10216. Herbig, G. H.; Zappala, R. R. (Univ. of California, Santa Cruz). Astrophys. J.; 162: L15-18(Oct 1970).

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Coudé spectrograms in the 7500 to 8700 Å region were obtained of the infrared sources NML Cyg and IRC + 10216. NML Cyg appears to be a normal M6 III, while IRC + 10216 is a late-type carbon star. (auth)

807 89 HERCULIS: AN F2 SUPERGIANT WITH LARGE CIRCUMSTELLAR INFRARED EMISSION. Gillett, F. C. (Univ. of California, San Diego); Hyland, A. R.; Stein, W. A. Astrophys. J.; 162: L21-4(Oct 1970).

A large unexpected flux of infrared radiation at wavelengths longer than 2 μ was observed from the F2 supergiant 89 Her, a star of normal chemical composition. The spectral shape and infrared flux are very similar to the same characteristics observed from the relatively carbon-rich supergiant R CrB. Three other F and G supergiants, ρ Cas, ϕ Cas, and HR 8752, show no infrared flux in excess of that expected from a blackbody at the effective temperature of the star over the same range of wavelength. The infrared radiation from 89 Her probably originates in a circumstellar shell of solid particles. (auth)

808 HELIUM ABUNDANCE IN THE ENVELOPES OF THE BLUEST RR LYRAE STARS IN GLOBULAR CLUSTERS. Iben, Icko Jr.; Huchra, John (Massachusetts Inst. of Tech., Cambridge). Astrophys. J.; 162: L43-4(Oct 1970).

Linear pulsation calculations that include radiation pressure result in a higher surface temperature for the blue edge of the instability strip. This reduces estimates of helium abundance by $\Delta Y \sim 0.06$ to $Y \sim 0.26$ to 0.29. (auth)

809 ELEMENT DIFFUSION AND ABUNDANCE ANOMALIES IN METALLIC A STARS. Watson, William D. (Massachusetts Inst. of Tech., Cambridge). Astrophys. J.; 162: L45-8(Oct 1970).

The diffusive separation of elements at the bases of the convective envelopes of metallic A stars is suggested as an explanation for the abundance anomalies of these stars. Such an explanation allows the possibility that metallic A anomalies can be understood in a manner similar to that recently suggested for magnetic A stars. (auth)

810 SOME NEW WHITE DWARFS WITH PECULIAR SPECTRA. VI. Greenstein, Jesse L. (California Inst. of Tech., Pasadena. Carnegie Institution of Washington, D. C.). Astrophys. J.; 162: L55-9(Oct 1970).

Spectroscopic data on eighteen newly observed white dwarfs are given. Very unusual spectra of several show molecular bands and lines of carbon. These are illustrated by intensity tracings. The spectrum of +70°8247 is probably not compatible with Zeeman-shifted hydrogen lines. (auth)

811 FURTHER POLARIZATION STUDIES OF Grw + 70^0 8247 AND OTHER WHITE DWARFS. Angel, J. R. P. (Columbia Univ., New York); Landstreet, J. D. Astrophys. J.; 162: L61-6 (Oct 1970).

Further observations of polarization in the white dwarf Grw + 70°8247 were made. The circular polarization in a broad band from 4000 to 6000 Å was found not to fluctuate by more than 3% on a time scale from 24 seconds to a few days. The circular polarization rose steeply from less than 1% at 3300 Å to 3.5% at 4000 Å, and then dropped slowly to 2.5% at 7600 Å. In ultraviolet and blue light the star showed a component of linear polarization of between 2 and 3.5% at a position angle of about 20°. Six other DC white dwarfs, one DA and one DBp, examined for circular polarization, gave null results generally to an accuracy of about 0.1%. (auth)

812 LARGE INFRARED CIRCULAR POLARIZATION OF Grw + $70^0$8247. Kemp, James C.; Swedlund, John B. (Univ. of Oregon, Eugene). Astrophys. J.; 162: L67-8(Oct 1970).

The percentage of circular polarization in light from the magnetic white dwarf Grw + 70°8247 was measured in a broad passband 0.9 to 1.6 μ, with estimated mean wavelengths of 1.15 and 1.25 μ, respectively, for two separate observations. Values 8.5 and 15%, respectively, were found, with the same polarization handedness as in previous measurements in the visible region. (auth)

813 QUANTUM-MAGNETIC FEATURES IN THE POLARIZED LIGHT OF Grw + $70^0$8247. Kemp, James C. (Univ. of Oregon, Eugene). Astrophys. J.; 162: L69-72(Oct 1970).

The curious quasi-periodic or "stepped" structure seen in the polarization spectra of Grw + 70°8247 is discussed. It is concluded that the magneto-emission mode here is an intermediate one between that of the weak-field "gray-body" theory and that of a strong-field, quantum-magnetic limit. It is postulated that two apparent structural peaks in the circular-polarization data correspond to the fundamental and third harmonic of a cyclotron frequency for $B_0 \simeq 10^8$ gauss, where B_0 is an rms value, some 4 times the projected value along the observer's direction. (auth)

814 PRESENCE OF SILICON MONOXIDE IN STELLAR SPECTRA. Wing, Robert F.; Price, Stephan D. (Ohio State Univ., Columbus. Ohio Wesleyan Univ., Delaware). Astrophys. J.; 162: L73-4(Oct 1970).

A recent identification of overtone rotation–vibration bands of SiO in the infrared spectra of late-type stars is almost certainly incorrect, since no account was taken of the extensive absorption by the red system of the CN. An earlier identification of the SiO fundamental band is more plausible but is still in need of confirmation. (auth)

815 FURTHER COMMENTS ON THE PRESENCE OF SILICON MONOXIDE BANDS IN SOME LOW-TEMPERATURE STARS. Fertel, Jeanne H. (Northeastern Univ., Boston). Astrophys. J.; 162: L75-6(Oct 1970).

Some infrared absorption features recently identified with SiO do not in general coincide with features attributable to CN. (auth)

816 SECULAR VARIATIONS IN THE INITIAL LUMINOSITY FUNCTION. Dixon, M. E. (Australian National Univ., Canberra). Mon. Notic. Roy. Astron. Soc.; 150: 195-205(1970).

A technique by which stellar space motion may be used as an age criterion is described. The technique is used to investigate past forms of the initial luminosity function. The results of the investigation indicate that the average initial luminosity function of nearby field stars, formed during the last 5×10^9 yr, continues to rise beyond $M_v = +6.0$, in contrast with the luminosity function of stars in recently formed clusters which declines beyond $M_v = +6.0$. Present results indicate that the gradient of the initial luminosity function of stars formed during the last 5×10^9 yr does not differ from that of the general luminosity function by more than a factor f = 2, in the interval $M_v = +6.0$ to +11.0. (auth) (UK)

817 SPECTROSCOPIC ORBIT OF THE O-TYPE SUBDWARF HD 49798. Thackeray, A. D. (Radcliffe Observatory, Pretoria). Mon. Notic. Roy. Astron. Soc.; 150: 215-25(1970).

A spectroscopic orbit of the single lined O6 binary HD 49798 is derived. The period is 1.5477 days and a mass-function of 0.272 ± 0.022 is found. The Jascheks' conclusion that the primary is a hot subdwarf (the brightest known) is confirmed in various ways. The lines of He II are very strong and nitrogen in various stages of ionization is prominent; N IV 6380.77 is found, probably for the first time in celestial spectra. Blended wavelengths (H + He II) are derived for Hβ and Hγ for the purpose of radial velocities. The absence of eclipses or of ellipsoidal variations rules out a normal O6 V star for the primary. The system stands off in a plot of $K \cdot \sqrt{1-e^2}$ against log P for O binaries. If the primary has a mass of $1.0_\odot$ or less in accordance with models of helium burning stars, the secondary must be more massive; a secondary on the normal main sequence could then only have a narrow range of type (late F) without becoming luminous enough to be detectable. A white dwarf secondary would provide the easiest way to satisfy the observations, but a spectrophotometric search for the companion in the infrared might be profitable. (auth) (UK)

818 ABUNDANCE OF HELIUM IN EARLY-TYPE STARS AND DEPARTURES FROM LOCAL THERMODYNAMIC EQUILIBRIUM. Hearn, A. G. (Sterrewacht Sonnenborgh, Utrecht). Mon. Notic. Roy. Astron. Soc.; 150: 227-34(1970).

If the strong absorption lines of neutral helium in an early-type star are formed in a layer with an electron density of 10^{15} cm^{-3} or less, the formation of the line will be dominated by departures from local thermodynamic equilibrium (LTE) and then it is not possible to obtain the helium abundance from measurements of the absorption lines. Calculations suggest that the variation in the helium absorption lines of main-sequence early-type stars could result from differences in the electron density of the layer where the lines are formed causing differences in the departures from LTE rather than from variations in the helium abundance. The equivalent width of a line is meaningless when the absorption line is dominated by departures from LTE and the resolution of the problems of departures from LTE and the abundance of helium in main-sequence early-type stars will require the measurement and comparison with calculations of many line profiles. (auth)(UK)

819 INFRARED SPECTRA OF M AND C STARS BETWEEN 4000 AND 9000 CM^{-1}. II. ATOMIC TRANSITIONS IDENTIFIED IN FOUR M STARS. Chauville, J.; Querci, F.; Connes, J.; Connes, P. (Institut d'Astrophysique, Paris). Astron. Astrophys., Suppl. Ser.; 2: 181-99(Aug 1970). (In French).

A list of atomic transitions is presented for 14 neutral elements observed in high-resolution infrared spectra of four M stars obtained with the Fourier transform technique. Most of these transitions were computed from energy levels and selection rules, since laboratory data are not always available for this

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wavelength region. All the lines belong to excited atoms, with excitation potentials up to 7 eV. Some of them are forbidden lines. (auth)

820 LIST AND CLASSIFICATION OF NEW M, C, AND EMISSION-LINE STARS. Barbier, M. (Marseille Observatoire). Astron. Astrophys., Suppl. Ser.; 2: 201-3(Aug 1970). (In French).

One hundred and one new M, C, and emission-line stars, discovered on objective-prism plates taken at Haute Provence Observatory, are listed. They are classified by means of criteria used in previous publications. Because of underexposure, the classification of the stars fainter than magnitude 12 is not accurate (auth)

821 SPECTROSCOPIC ANALYSIS OF FIVE STARS OF THE γ LEONIS GROUP (SPECTROSCOPIC DATA AND ELEMENT ABUNDANCES). Zielke, G. (Univ., Kiel). Astron. Astrophys., Suppl. Ser.; 2: 205-21(Aug 1970). (In German).

The method of differential fine analysis was applied to five stars of the γ Leonis group: HD 105590, HD 136202, HD 155646, HD 208776, and HD 208906. Spectra of 10 Å/mm in the photographic, and of 15 Å/mm in the visual, region were used. The star HD 136202, for which the most extensive material is available, was analyzed relative to the Sun, the other four stars relative to HD 136202. The measured equivalent widths, the spectroscopic data, and the resulting abundances for all the lines used in the analysis, are listed. (auth)

822 PHOTOELECTRIC OBSERVATIONS OF FLARE STARS. I. Cristaldi, S.; Rodono, M. (Catania Astrophysical Observatory, Italy). Astron. Astrophys., Suppl. Ser.; 2: 223-49(Aug 1970).

The results are given of photoelectric observations of UV Cet, PZ Mon, YZ CMi, AD Leo, BD + 55°1823, BY Dra, and EV Lac made at the Catania Astrophysical Observatory during 1967 and 1968. (auth)

823 PHOTOELECTRIC PHOTOMETRY OF EARLY-TYPE STARS IN A MILKY WAY FIELD IN CEPHEUS. Saerg, K.; Wramdemark, S. (Lund Astronomical Observatory, Sweden). Astron. Astrophys., Suppl. Ser.; 2: 251-9(Aug 1970).

Photoelectric measurements in the standard UBV system are presented for 150 early-type stars in a Milky Way field in Cepheus. (auth)

824 T AURIGAE, EX HYDRAE, AND U GEMINORUM: ADDITIONAL TIMES OF MINIMA. Mumford, George S. (Tufts Univ., Medford, Mass. Kitt Peak National Observatory, Tucson, Ariz.). Astrophys. J.; 162: 363-5(Oct 1970).

Recent observations confirm an apparent increase in the period of the eclipsing nova-like variable, U Gem. (auth)

825 RATE OF THE $^{12}C + {}^{12}C$ REACTION. Arnett, W. David (Rice Univ., Houston, Tex.). Astrophys. J.; 162: 349-51 (Oct 1970).

The recent experimental determination by Patterson, Winkler, and Zaidins of the cross section for the $^{12}C + {}^{12}C$ reaction reduces the uncertainty in the rate of carbon burning in stars to much less than that assumed in some recent evolutionary calculations. A short discussion is presented for clarification of this point. (auth)

826 WERE THE LIGHTEST STABLE ISOTOPES PRODUCED BY PHOTODISSOCIATION? Macklin, R. L. (Oak Ridge National Lab., Tenn.). Astrophys. J.; 162: 353-5(Oct 1970).

Evidence is presented for a strong correlation between p-process abundances and neutron binding energies. (auth)

827 FLARE STARS AS X-RAY SOURCES. Grindlay, Jonathan E. (Harvard Coll. Observatory, Cambridge, Mass. Smithsonian Astrophysical Observatory, Cambridge, Mass.). Astrophys. J.; 162: 187-98(Oct 1970).

Observations in the radio and optical spectral regions of two classes of flare of UV Ceti are interpreted by various models. These models are used to calculate the approximate spectrum of electrons accelerated by the flares, without regard for the particular acceleration mechanism. The production of x rays with energies at least 10 keV is then predicted by nonthermal bremsstrahlung of the calculated electron spectrum in a proton gas at chromospheric densities $10^{10} < n_i < 10^{15}$ cm^{-3}. An approximate x-ray flux of 2.6 photons cm^{-2} sec^{-1} at Earth is predicted for a typical UV Ceti flare. Such an x-ray flare is expected to be of short duration ($T \lesssim 1$ min) and should be looked for in coincidence with optical and radio observations of flares. (auth)

828 COMPOSITE SPECTRUM OF CPD-56°3586 AND THE LUMINOSITY OF ITS SUPERGIANT COMPONENT. Keenan, Philip C. (Ohio State Univ., Columbus. Ohio Wesleyan Univ., Delaware). Astrophys. J.; 162: 199-202(Oct 1970).

The two components of CPD-56°3586, of spectral types M3 Iab and B2 V, have equal intensity in their radiation near 4100 Å. This allows the estimation of $M_v = -5.3$ for the supergiant component. The pair is similar to the well-known VV Cephei group system BS 8164 (Boss 5481), the red member of which is estimated to be M1 Ib, with $M_v = -4.9$. Another southern supergiant with a spectrum composite in the violet is HD 101007. (auth)

829 NEAR-INFRARED SPECTRA OF M, S, AND CARBON STARS. Wyckoff, Susan. Astrophys. J.; 162: 203-16(Oct 1970).

Low-dispersion near-infrared slit spectra of a sample of M, S, and carbon stars were examined. It was found that the spectral types of twenty-nine M-type long-period variables observed near minimum light define a period–spectrum relation which parallels, at about three subtypes later, the analogous relation for types at maximum light. Changes in molecular-band strengths as a function of phase in the spectra of several stars reaffirm the temperature changes in M and S long-period variables. Four unidentified infrared bands probably characterize the cooler S stars with high Zr/Ti abundance ratios. Infrared spectra of R Cygni indicated that the four bands are quite sensitive to phase in the light cycle. A small sample of carbon stars was classified according to criteria in the visual spectral region. Evidence is presented that the infrared bands of the red cyanogen system weaken at spectral types later than C7. In addition, infrared spectrograms of three stars intermediate between carbon and S exhibit cyanogen-band strengths comparable to those found in the latest and presumably coolest carbon stars. It is suggested that the nitrogen abundance in the atmospheres of stars with S characteristics is high relative to carbon stars and that a possible source of the ultraviolet opacity in N and carbon-S stars is the CN^- molecule. (auth)

830 PHOTOMETRY OF HIGH-LUMINOSITY M-TYPE STARS. Lee, Thomas A. (Goddard Inst. for Space Studies, New York. Univ. of Arizona, Tucson). Astrophys. J.; 162: 217-38(Oct 1970).

Photometric observations extending to 3.4 μ are presented for a sample of high-luminosity M stars. Intrinsic properties (color indices, effective temperatures, bolometric corrections) are determined for giants and supergiants; the supergiants are redder than the giants and have slightly lower effective temperatures. A weak luminosity distinction among the supergiants is seen in the infrared color data. The mean law of interstellar extinction, derived from the colors of distant reddened M supergiants, yields $R = 3.6 \pm 0.3$ (for M stars), and no large-scale anomalous regions are found. The extreme Population I character of M supergiants is confirmed by their spatial distribution. They are highly concentrated to the galactic plane and suggest the same spiral structure shown by other early-type objects. The Ia supergiants show the strongest concentration in the plane—equal to that of the O and B stars. (auth)

831 ATMOSPHERES OF THE HOT SUBDWARFS HD 127493, HD 128220, AND HD 113001. Tomley, Les (Univ. of Hawaii, Honolulu). Astrophys. J.; 162: 239-58(Oct 1970).

A model-atmosphere analysis of three hot subdwarfs, HD 127493 and the subdwarf components of the binary systems HD 128220 and HD 113001, was performed with the aid of data from moderately high-dispersion spectrograms (13 to 16 Å mm^{-1}). The separation of the contributions to the continuum of each member of the binary systems was accomplished by using published spectral scans and the predictions of model atmospheres. Equivalent-width ratios for lines from two ionization states of one element and the observed profiles of H, He I, and He II lines, which are broadened primarily by the Stark effect, were compared with predictions from the model atmospheres to determine the atmospheric parameters. HD 127493 and HD 113001 were found to be well represented by a model with $T_e = 41000$°K, $\log g_* = +5.7$, and $X = 0.5$ whereas HD 128220 required $T_e = 41000$°K, $\log g_* = +4.7$, and $X = 0.6$. The microturbulent velocity for all three stars was between 5 and 10 km sec^{-1}. Abundances were calculated for C, N, O, Ne, and Si (and Mg for HD 127493), and the significant finding besides the He enhancement was a definite rearrangement of the CNO abundances for HD 127493 and HD 113001 and a possible mild rearrangement of the CNO abundances in HD 128220. There was no evidence that Ne and Si were abnormal in any of the stars. The present observed abundances are examined from the standpoint of stellar evolution and nuclear processing. A scheme is presented in which the hot subdwarfs evolve from an initially normal composition and undergo mixing of their outer regions at a later stage of evolution. (auth)

832 ATMOSPHERIC STRUCTURE OF COOL STARS WITH PARTICLE OPACITY. Krishna Swamy, K. S. (Rice Univ., Houston, Tex.). Astrophys. J.; 162: 259-64(Oct 1970).

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A comparative study of the model atmospheres of cool stars with and without the inclusion of graphite-particle opacity was made. It was found that the extinction due to graphite particles is appreciable compared with the absorption due to other sources. Therefore, for a discussion of cool stars where particle formation is possible, it was necessary to take into account the opacity due to the particles in the computation of the model atmosphere. (auth)

833 SYNTHESIS OF CLOSE-BINARY LIGHT CURVES. I. THE REFLECTION EFFECT AND DISTORTION IN ALGOL. Hill, Graham; Hutchings, J. B. (Dominion Astrophysical Observatory, B. C.). Astrophys. J.; 162: 265-80 (Oct 1970).

The results of theoretical investigations of the reflection effect and gravitational distortion were used to synthesize monochromatic light curves for close-binary systems. Detailed application was made to the Algol system, and a very close fit with unrectified observations at six wavelengths was obtained. Physical data for the system, including the noneclipsing third body, were: relative radii 0.243 (polar), 0.214, and 0.105; effective temperatures 4700°, 10800°, and 8300°K; orbital inclination 81.6°; mass ratio 4.0; and gravity-darkening exponent 0.08. (auth)

834 CIRCULAR POLARIZATION OF THERMAL RADIATION IN A MAGNETIC FIELD. Kemp, James C. (Univ. of Oregon, Eugene). Astrophys. J.; 162: 169-79 (Oct 1970).

It is argued that light emission of electronic origin from any thermal source in a magnetic field is characterized by a spectrally diffuse circular polarization along the B field, even when the emission is devoid of spectral structure, i.e., is blackbody-like. A model "gray-body" radiating system in a B field is shown to emit with a fractional circular polarization given to first order in B by $q(\omega) \sim -(eB/m)/\omega$, where ω is the optical frequency. For $B = 10^5$ gauss, $q \sim 10^{-4}$ at visible wavelengths. The polarization is right-handed for B along the light k-vector. The effect has implications for the detection of magnetic fields in condensed stars (such as white dwarfs) and other stellar objects, and also for plasma and solid-state physics. Results of a preliminary laboratory experiment, which has verified the reality of the effect, are also summarized. (auth)

835 STRUCTURE AND EVOLUTION OF RAPIDLY ROTATING B-TYPE STARS. Sackmann, I.-Juliana; Anand, S. P. S. (Univ. of Toronto). Astrophys. J.; 162: 105-24 (Oct 1970).

Sixty-four interior main-sequence models of slowly and rapidly rotating B-type stars are presented. The mass of the models ranges from 5 to 15 $M_\odot$ and the rotation is taken as uniform. It is found that the changes brought about by rotation are smaller than previously thought. The total decrease in the luminosity is only 6.7%; and that of the polar radius, only 1 to 2% when the rotation ranges from zero to the critical value. The percentage luminosity change produced by rotation is remarkably constant for stars on the upper main sequence. The first quantitative computations on the evolution of uniformly rotating stars are presented. Three evolutionary sequences of a 10 $M_\odot$ star starting off from the main sequence with different rotational velocities are computed. The models are assumed to conserve their total angular momentum and to maintain uniform rotation as they evolve. The most interesting result found here is that models with an initial rapid or moderate rotation reach critical rotation very early in their evolution away from the main sequence, long before their gravitational-contraction phase occurs. Only for an extremely slow initial rotation can a model evolve to its gravitational-contraction phase before critical rotation sets in. (auth)

836 HYDRODYNAMICS OF THE HELIUM CORE FLASH. Tomasko, Martin G. (Princeton Univ. Observatory, N. J.). Astrophys. J.; 162: 125-38 (Oct 1970).

The importance of hydrodynamical effects during the helium-core-flash phase of stellar evolution is investigated in two parts. First, the cores of hydrostatically computed stellar models at the peak of the helium flash are shown to be pulsationally stable having periods of approximately 30 seconds and damping times of from about 20 to more than 100 periods depending on peak flash height. This may indicate that hydrodynamical effects generally do not greatly alter the course of the flash. Second, the hydrodynamical consequences for the outer regions of the star are investigated based on the assumption that the core evolution follows previous hydrostatic computations. Linearized numerical computations of the traveling wave launched by the expansion of the core occurring during the flash indicate that the wave loses most of its energy by lifting the passed-over material to a new hydrostatic equilibrium, and can lead to a loss of less than some 10^{-5} of the star's mass when it reaches the surface. It is concluded that, unless other effects result in a change of the basic time scale for the helium core flash, it is unlikely that hydrodynamical effects will substantially alter post-flash evolution from that indicated by previous hydrostatic computations. (auth)

837 PULSATION CONSTANTS FOR MODELS OF CEPHEIDS, Cogan, Bruce C. (Amherst Coll., Mass.). Astrophys. J.; 162: 139-44 (Oct 1970).

The pulsation constants for the fundamental and first and second harmonics were calculated for fifty-three Cepheid envelope models. The models, with composition X = 0.602, Y = 0.354, cover the entire Cepheid strip. The pulsation constants are found to depend strongly upon the ratio of mass to radius. On the basis of these calculations, the masses of thirteen Cepheids found in open clusters are calculated. The masses are substantially smaller than those predicted by evolutionary tracks. (auth)

838 VARIATIONAL PRINCIPLE FOR ROTATING STARS IN GENERAL RELATIVITY. Bardeen, James M. (Univ. of Washington, Seattle). Contract AT(11-1)-34. Astrophys. J.; 162: 71-95 (Oct 1970).

A variational principle for the structure of differentially rotating stars in general relativity is developed both as an action principle from which the Einstein equations and the equation of hydrostatic equilibrium can be derived and as an energy-extremization principle. It is shown that the equilibrium configuration of the star and its gravitational field extremizes the gravitational mass of momentarily stationary, axisymmetric configurations which satisfy the initial-value equations of general relativity and in which each ring of matter has a fixed number of baryons, a fixed angular momentum, and a fixed entropy per baryon. A simple positive-definite expression for the gravitational mass of such a momentarily stationary configuration is obtained directly from the initial-value equations. Ways in which the different forms of the variational principle can be used in numerical calculations of the structure of rotating stars in a general relativity are discussed, as well as some analytic results relating to stability against convection. (auth)

839 EXPANSIONS OF THE PLANETARY NEBULAE NGC 6853 AND IC 3568. Bohuski, Thomas J. (Univ. of Texas, Austin); Smith, Malcolm G.; Weedman, Daniel W. Astrophys. J.; 162: 27-31 (Oct 1970).

The nearby planetary nebula NGC 6853, the Dumbbell Nebula, was observed at nine different positions with a pressure-scanned, Fabry–Perot interferometer, and the [N II] emitting region was found to be expanding like a spherical shell at 31 km sec^{-1}. It is concluded that the apparent angular rate of growth for the nebula can be derived by using the observed expansion velocity, as was assumed by Liller in deriving the distance to this planetary. The symmetrical planetary IC 3568 was observed with a coudé spectrograph at 1.85 Å mm^{-1} and was found to have an expansion velocity of 7.8 km sec^{-1}, which is the lowest yet detected for a planetary nebula. This planetary was found to have distinct inhomogeneities so that it cannot be regarded as a perfectly symmetric spherical nebula. (auth)

840 AXIALLY SYMMETRIC MODEL PLANETARY NEBULAE. Kirkpatrick, Ronald C. (Goddard Space Flight Center, Greenbelt, Md.). Astrophys. J.; 162: 33-47 (Oct 1970).

Axially symmetric models of the planetary nebulae NGC 7662 and NGC 7009 were constructed on the basis of the nebular density distributions deduced by Weedman and the hydrogen-continuum threshold optical depths and central-star temperatures deduced by Capriotti and Kovach. These models are in fair agreement with observations for some of the forbidden lines ([O III], [Ne III], [Ar IV]) but in very poor agreement for other forbidden lines ([N II], [O II], [S II]). For NGC 7662 the intensity distributions along the slit length predicted by the model are in fair agreement with those observed by Minkowski and Aller. A grid of optically thin model condensations is used to analyze the character of inhomogeneities indicated by the spectrum of NGC 7009 and to show that optically thin inhomogeneities cannot account for the discrepancies between the predicted and the observed ratios of forbidden lines arising from different ions of the same element. (auth)

841 TRIPLE-ALPHA REACTION AT HIGH TEMPERATURES. Duorah, K.; Duorah, H. L. (Gauhati Univ., India). Indian J. Pure Appl. Phys.; 6: 263-5 (1968).

The triple-alpha reaction is examined at higher temperatures. The resonant reaction rates are calculated for 9.63(3−) and 10.1 (0+) MeV levels of ^{12}C. The reaction rates, even through the latter level, may be fast enough to account for (a) the rapid production of 4N nuclei in the supernova envelope and (b) the rapid addition of ^{16}O to the depleted oxygen-burning core of massive stars. (auth)

842 POLARIZATION OF IRC + 10216. Shawl, Stephen J. (Univ. of Arizona, Tucson. Univ. of Texas, Austin); Zellner, Ben. Astrophys. J.; 162: L19-20 (Oct 1970).

Linear polarization in excess of 20% was observed for the infrared object IRC + 10216 at wavelengths near 1 μ. (auth)

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843 PECULIAR A STAR HD 168733. I. A LINE-IDENTIFICATION LIST. Little, Stephen J.; Aller, Lawrence H. (Univ. of California, Los Angeles). Astrophys. J., Suppl. Ser.; 22: No. 185, 157-76(Oct 1970).

Equivalent widths for more than 1200 spectral lines in the peculiar star HD 168733 (B7–8p) were measured over the spectral range 3456 to 6600 Å. Line identifications as well as hydrogen-line profiles are listed, and the radial velocity of the star was reduced from each plate. The peculiarities of the spectrum of this star were first pointed out by Bidelman, who first identified some of the lines. The details of the reduction are described, and remarks are made concerning the usefulness of certain lines for abundance analysis. Lines of twenty ionized states of sixteen elements were found in the spectrum. (auth)

844 COSMIC STUDIES OF RADIATION FROM STARS, NEBULAE, AND GALAXIES (SYMPOSIUM IN HOLLAND). Severnyi, A. B. Vestn. Akad. Nauk SSSR; No. 11, 91-5(1969). (In Russian).

The study of ultraviolet radiation beyond the confines of the Earth is of fundamental importance in cosmic processes. A new method of calibrating ultraviolet receivers is based on comparing the intensity of two spectral lines, one emitting in the ultraviolet and the other in the visible part of the spectrum, but having a common, upper energy level. The ratio of the intensities of these lines is determined only by the transition probabilities which are known with great accuracy for a series of atomic transitions. A second method of calibration is based on comparing a source of synchronous radiation in the visible and ultraviolet regions. The synchronous radiation decreases regularly with increasing wavelength and is an excellent source for relative calibration of intensity. Cherenkov radiation sources are also used as secondary standards. It is noted that the attenuation of radiation is inversely proportional to its wavelength, as shown by a comparison of rocket measurements of energy distribution in the ultraviolet spectrum of far and near stars. However, an increase in absorption is observed at a wavelength of about 2000 Å. It is theorized that graphite particles in space may be the cause of this increased absorption. The work of Morton in deriving a new scale of star temperatures is mentioned. A decrease in ultraviolet flux may be due to the presence of silicon and carbon in some hot stars (temperature greater than 10,000°). Good agreement with observations taken outside the Earth's atmosphere can be expected with theory by assuming a "cover" effect, where part of the radiation is absorbed by the atmosphere of the star and is used to increase the temperature of the stellar body. Television on the Orbital Astronomical Laboratory is used to photograph directly stars and nebulae in the ultraviolet part of the spectrum (1000 to 3000 Å). This television data showed that the Orion Nebula was much brighter than was previously supposed. Also several stars in the Orion constellation are brighter than theory would predict. (TTT)

845 MOTION OF TEST MASSES IN THE GRAVITATIONAL FIELD OF A ROTATING BODY. Mitskevich, N. V.; Pulido Garcia, I. (Patrice Lumumba Univ., Moscow). Dokl. Akad. Nauk SSSR; 192: 1263-5(21 Jun 1970). (In Russian).

Components of the static gravitational field of a massive rotative body effect the motion of test bodies leading to orbital precessions. The effect is largest when the Thirring–Lense effect is close to the zero (Newtonian) approximation but its overall value amounts only to a small correction. Thus, if two masses move toward each other in the same equatorial orbit, their rotational periods will be different. The resulting drift was calculated by solving the external gravitational field of a rotating symmetric mass derived by Kerr. An exact expression was obtained for the rotational period. The effect is illustrated within the solar system, within which the drift of the point of meeting is orders of magnitude larger than the reversal of the peribelion of Mercury. The effects due to the rotation of the central body and to the Schwarzschild rotation of its gravitational field are both of the same order of magnitude for fast-rotating, A, O, and B class stars. (TTT)

846 $^{14}N(p,\gamma)^{15}O$ REACTION IN THE CN CYCLE. Duorah, K.; Duorah, H. L. (Gauhati Univ., India). Indian J. Pure Appl. Phys.; 6: 389-90(1968).

The $^{14}N(p,\gamma)^{15}O$ reaction through a bound level of ^{15}O at the 7.276 MeV and its possible effect on the abundance distribution of CN cycle products was examined. The rate is found to be too slow at all stellar temperatures compared to the nonresonance rate calculated from the experimental observation due to Lamb and Hester [Phys. Rev., 108(1957), 304]. If a situation exists such that helium burning products pass through the hot hydrogen zone in giant stars over a period of $\lesssim 10^3$ years, the products may manifest at the surface to show a large abundance of ^{14}N compared to ^{12}C in conformity with certain observations. (auth)

847 STARS OF THE MAIN SEQUENCE. Barcza, Szabolcs (Astronomical Observatory, Budapest). Fiz. Szemle; 20: 202-7(1970). (In Hungarian).

A relatively stationary period in the development of stars was chosen for closer study. The longest such period is that involving the main branch of the Hertzsprung–Russell diagram, covering more than 90% of the observed stars. The closest star, the Sun, is used to present a numerical study of the superficial potential energy. The gravitational energy is able to cover the emission of the Sun for about 30 million years. Current studies are centered on the role of hydrogen as the primordial matter. Development of a suitable star model requires knowledge of the functions concerning density, pressure, temperature, luminosity, and chemical composition distribution; however, the available data refer only to the surface. Most of the prevailing conditions cannot be reproduced on the Earth and must be based on calculations. It was concluded that the energy of the stars is derived from nuclear reactions. (TTT)

848 SPECTRUM OF THE MANGANESE STAR ι CORONAE BOREALIS. Aller, Lawrence H.; Ross, John E. (Univ. of California, Los Angeles). Astrophys. Space Sci.; 8: 262-6(Aug 1970).

Iota Coronae Borealis is a manganese–mercury star with a rich spectrum of sharp lines. Equivalent widths are tabulated element by element from data obtained at the Lick 120-inch telescope. (auth)

849 SPECTRUM OF THE MANGANESE–SCANDIUM STAR φ HERCULIS. Aller, Lawrence H.; Ross, John E.; Zimmermann, R. Erik (Univ. of California, Los Angeles). Astrophys. Space Sci.; 8: 267-74(Aug 1970).

Among manganese stars, φ Herculis is of great interest because of the unusual strength of the scandium lines. Intensity measurements are presented for numerous lines of C II, Mg I, Mg II, Si II, Ca II, Sc II, Ti II, Cr II, Mn I, Mn II, Fe I, Fe II, Co II, Sr II, Y II, and Zr II. (auth)

850 AMPLITUDE RATIOS OF SEVERAL GROUPS OF VARIABLE STARS. Leung, Kam-ching (Goddard Space Flight Center, New York). Astrophys. Space Sci.; 8: 222-6(Aug 1970).

The observed positions of classical Cepheids, RR Lyrae stars, δ Scuti stars, and dwarf Cepheids in the log g–log T_e plane form a continuous sequence, thereby defining the location of maximum instability. The amplitude ratio (the ratio of radial velocity amplitude to light amplitude) is small for variables at the upper end of the instability strip and increases almost linearly towards the lower end of the strip. The theory of radial pulsation predicts the trend of this correlation. (auth)

851 POLARIZATION OF RADIATION FROM STELLAR ATMOSPHERES: THE GREY CASE. Harrington, J. Patrick (Univ. of Maryland, College Park). Astrophys. Space Sci.; 8: 227-42(Aug 1970).

An accurate numerical method is presented for the solution of the transfer equations in a plane-parallel atmosphere in which scattering occurs according to Rayleigh's law. Some results are given for the polarization and limb darkening of both integrated and monochromatic radiation emerging from grey atmospheres with various ratios of scattering to absorption. The method is equally applicable to nongrey atmospheres. (auth)

852 ROCHE COORDINATES IN THREE DIMENSIONS AND THEIR APPLICATION TO PROBLEMS OF DOUBLE-STAR ASTRONOMY. Kopal, Zdenek (Boeing Scientific Research Labs., Seattle). Astrophys. Space Sci.; 8: 149-71(Aug 1970).

Section 1 contains a general outline of the proposed three-dimensional transformation; in Section 2, details of this transformation are explicitly worked out correctly to quantities of first order in superficial distortion—an approximation that should prove adequate in regions surrounding the two finite masses; in Section 3, the metric coefficients of the respective transformation and its direction cosines are evaluated, in both polar and curvilinear coordinates. Section 4 contains a formulation of the fundamental equations of hydrodynamics in terms of the three-dimensional Roche coordinates; and their advantages for a treatment of certain classes of dynamical problems encountered in double-star astronomy are illustrated in Section 5 by an investigation of the vibrational stability of the Roche model. It is shown that this model is capable of performing free radial oscillations that remain barotropic only if its equilibrium form is spherical (i.e., in the absence of any external mass in the neighborhood); but not if it is distorted to any extent by rotation or tides. (auth)

853 LIGHT-ELEMENT ABUNDANCES OF PECULIAR A STARS. Guthrie, B. N. G. (Royal Observatory, Edinburgh). Astrophys. Space Sci.; 8: 172-84(Aug 1970).

Light-element abundances were compiled for six peculiar A stars (3 CenA, α^2 CVn, HR 1732, ν For, κ Cnc, and 112 Her) with He I lines very weak for their colors. The abundances were interpreted on the theory that peculiar A stars were once secondaries in binary systems in which the primaries exploded as type-II supernovae. During the explosions of the primaries, protons were accelerated to high energies (>20 MeV) in shock waves at the secondaries, and spallation of He, C, N, and O occurred. This was followed by the arrival of heavier elements from the primaries. Abundances on α^2 CVn, HR 1732, and ν For were subsequently modified by surface nuclear reactions involving protons and α-particles accelerated to lower energies (~10 MeV), probably by magnetic fields. Successive (α,γ) reactions formed ^{28}Si from ^{20}Ne, and (p,α) reactions acting on ^{40}A and ^{40}Ca may have contributed to the excesses of Cl observed on α^2 CVn and HR 1732. These proposals have interesting implications with regard to the relative abundances of the iron-peak elements found on peculiar A stars and in the solar system. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstract 1078.

854 (N-70-35168) MODEL FOR THE RADIATIONS FROM THE COMPACT STRONG SOURCES. Cavaliere, A.; Morrison, P.; Pacini, F. (Massachusetts Inst. of Tech., Cambridge. Center for Space Research. Cornell-Sydney Univ. Astronomy Centre, Sydney (Australia)). [1970]. Contract N00014-67-A-0077-0007. 18p. (NASA-CR-109971; CSR-TR-70-5). NTIS.

A model for the origins and time variations of the radiation spectrum of a typical source over all wave bands is presented. The type example is the quasar 3C 273B; various other active galactic nuclei are included by extension. Primary synchrotron emission is in the infrared; the steep decline on the low-frequency side of the power peak is due, not to self-absorption, but to the cyclotron turnover. Optical and x-ray continua are Compton-recoil photons; the radio outbursts arise in the familiar expanding clouds. The dynamical model that naturally fits the requirements is that of a condensed, rotating, magnetized body, evolving nonthermally the spinar. (auth) (STAR)

855 DETECTION AND IDENTIFICATION OF RECOMBINATION LINES FROM AN H I REGION. Ball, J. A.; Cesarsky, D.; Dupree, A. K.; Goldberg, L.; Lilley, A. E. (Harvard Coll. Observatory, Cambridge, Mass.). Astrophys. J.; 162: L25-9 (Oct 1970).

The H157a line arising from an H I region was observed in the spectrum of NGC 2024 (Orion B). The measured frequency separation between this line and the anomalous line at 157a allows a firm identification of the anomalous emitter as carbon. The fraction of ionized hydrogen in this H I cloud is found to be $(2.7 \pm 1.8) \times 10^{-4}$. (auth)

856 IMPROVED SPECTRA OF SOME OHIO RADIO SOURCES WITH UNUSUAL SPECTRA. Jauncey, D. L. (Cornell Univ., Ithaca, N. Y.); Niell, A. E.; Condon, J. J. Astrophys. J.; 162: L31-6 (Oct 1970).

Accurate flux-density measurements at 318 and 606 MHz are presented for forty-seven Ohio sources with unusual spectra. Many of the sources show a more complex spectral behavior than previously reported, and require several components to describe their spectra. It is argued that even the flat-spectrum sources are probably a superposition of normal-spectrum components that become optically thick at different frequencies. (auth)

857 LOW-FREQUENCY CUTOFFS IN SYNCHROTRON SPECTRA. O'Dell, Stephen L.; Sartori, L. (Massachusetts Inst. of Tech., Cambridge). Astrophys. J.; 162: L37-42 (Oct 1970). 1970).

A natural low-frequency cutoff in the spectrum of a synchrotron source is described. The maximum in the emission spectrum occurs at about the frequency $\nu_B/\bar{\xi}$, where ν_B is the cyclotron frequency and $\bar{\xi}$ is the average pitch angle in the source. If above this turnover frequency $P_\nu \sim \nu^{-a}$, then below it, $P_\nu \sim \nu^{2a+1}$. A model for the high-frequency spectrum of pulsar NP 0532 is discussed. (auth)

858 PULSARS TODAY. I. Green, Louis C. (Haverford Coll., Pa.). Sky Telesc.; 40: 260-2 (Nov 1970).

The four fundamental families of stars (ordinary stars, white dwarfs, neutron stars, and collapsed stars) are briefly discussed. The present picture of a pulsar is reviewed, and the pulsar distribution in the Galaxy is discussed. (W.D.M.)

859 FINE STRUCTURE IN RADIO SOURCES AT METRE WAVELENGTHS. I. THE OBSERVATIONS. Hewish, A.; Burnell, S. J. (Cavendish Lab., Cambridge, Eng.). Mon. Notic. Roy. Astron. Soc.; 150: 141-7 (1970).

A survey of radio sources in the declination range −10° to +90° is in progress at a frequency of 81.5 MHz. The object of the survey is the study of angular structure on a scale <1″ using the method of interplanetary scintillation. A description of the radio telescope which was constructed for this purpose is given and the observational technique is outlined. The system is also of interest in connection with the discovery of pulsars. (auth) (UK)

860 PULSAR NULLING PHENOMENA. Backer, D. C. (Arecibo Observatory, Puerto Rico). Nature (London); 228: 42-3 (3 Oct 1970).

During an investigation of the short-term behavior of pulsar radiation during strong bursts several pulsars were observed to show pulse nulling. PSRs 0834 + 06, 1133 + 16, 1237 + 25, and 1929 + 10 suddenly missed from one to ten pulses at various times, referred to as "nulls," during otherwise very strong and steady bursts. In this context a "null" means that the pulse energy decreased by a factor of ten or more over one or two pulse periods and then increased sharply, and such "nulls" are divided into two types. The spacing of the "nulls" suggests that they may recur periodically and hence contribute to responses at characteristic periods in pulse energy fluctuation power spectra. The observations were made using linearly polarized feeds at 318 and 606 MHz and a circularly polarized feed at 430 MHz. Both types of "nulls" were correlated over hundreds of MHz, and the short duration, the correlation over a wide frequency range, and the possible periodicity indicate that the radiation-producing structure undergoes some rapid changes. A detailed analysis is presented, together with further interpretations. Pulse energy distributions are shown graphically for pulses within a strong burst for three of the pulsars. (UK)

861 EVOLUTION OF RADIO SOURCES: THE ORIGIN OF COSMIC RAYS AND THE X-RAY BACKGROUND. Longair, M. S. (Cavendish Lab., Cambridge, Eng.). Mon. Notic. Roy. Astron. Soc.; 150: 155-71 (1970).

Three interrelated problems are discussed—the theory of the extragalactic origin of cosmic rays, the origin of the x-ray background, and the evolution of extragalactic radio sources. Cosmic-ray electrons originating in extragalactic radio sources produce not only radio waves by the synchrotron mechanism but also x rays by inverse Compton scattering of the relict radiation. The latter is likely to be the dominant loss mechanism for electrons at large redshifts. There then exists a simple relation between the local flux of cosmic rays and the x-ray background. Using the conventional value K = 100 for the ratio K of energy densities in relativistic protons and electrons generated in radio sources, the upper limit to the local energy density of cosmic rays due to extragalactic radio sources is 10^{-3} eV cm^{-3}. Only if $K > 10^4$ can the whole of the observed cosmic rays be attributed to extragalactic sources. Although the total energy associated with the x-ray background can be produced in this model, there are very severe difficulties in accounting for the break in the observed background spectrum at $\epsilon_x \sim 40$ keV. These arise because the available radio data give information about the injection spectra of cosmic-ray electrons into the intergalactic medium. It is also shown that the apparent cutoff in the distribution of radio sources at large redshifts cannot be attributed to the effects of inverse Compton scattering. (auth) (UK)

862 FINE STRUCTURE OF NEBULAR EMISSION LINES. Meaburn, J. (Univ. of Manchester, Eng.). Nature (London); 228: 44 (3 Oct 1970).

The possibility that nebular lines may have significant fine structure appears to have been neglected by spectroscopists when considering the turbulent and thermal broadening of these lines. An estimate is made here of the error introduced into measurements of the electron temperatures of H II regions from the width of the Hα line if fine structure is neglected. An error of about +2,000°K is found, and it is considered possible that all measurements of the temperature of gaseous nebulae that have relied on the width of the Hα line have been overestimated by 2,000°K. Methods that depend on the widths of [N II] and Hα are even further uncertain if the fine structure of this forbidden line is neglected. It would seem necessary to consider the fine structure of all nebular lines in the conditions existing in nebulae when making exact measurements of their widths and shapes. (UK)

863 MOTION OF CURRENT SHEETS, AND THE RADIO, OPTICAL, AND X-RAY EMISSION FROM PULSARS. III. THE INDEPENDENT-PARTICLE PICTURE AND RADIATION. Ler-

XUM

che, I. (Univ. of Chicago). Contract F-19628-69-C-0041. Astrophys. J.; 162: 153-60(Oct 1970).

The high-frequency radiation field from a relativistically oscillating interface is computed under the assumption that the individual particles in the interface are completely uncorrelated. The frequency spectrum, the finite pulse width, fine time structure, and polarization of the individual-particle emission resemble the observed pulsar emission. It is shown that the differential power spectrum varies as ω^{-a} similar to that obtained by using a correlated Lorentz current approach. Calculations based on the assumption of independently radiating particles give a radiation spectrum which is believed to be valid for wavelengths short compared with the internal correlation length in the interface, whereas the earlier correlated-current picture gave a radiation spectrum which is believed to be valid for wavelengths long compared with the internal correlation length. So at both long and short wavelengths the differential power spectrum varies as ω^{-a} with $0.67 \lesssim a \lesssim 2$. It is suggested that the observed emission originates in such an oscillating interface. (auth)

864 SEARCH FOR RAPID OPTICAL OSCILLATIONS IN SCORPIUS XR-1. Lampton, M.; Bowyer, C. S.; Harrington, S. (Univ. of California, Berkeley). Astrophys. J.; 162: 181-6 (Oct 1970).

Power spectra of the optical intensity of Sco XR-1 were obtained for frequencies between 0.002 and 500 c/s which cover the observed range of pulsar frequencies and the predicted range of fundamental radial-mode vibrations in white dwarfs and neutron stars. No persistent oscillations were detected at these frequencies. (auth)

865 BRIGHTNESS AND POLARIZATION STRUCTURE OF THREE SUPERNOVA REMNANTS AT 6- AND 11-CENTIMETER WAVELENGTHS. Kundu, M. R. (Univ. of Maryland, College Park). Astrophys. J.; 162: 17-26(Oct 1970).

Distributions of brightness and polarization of three known supernova remnants Puppis A, W28, and PKS 1459−41 (S.N. 1006) were measured at 6- and 11-cm wavelengths. Significant polarization was detected in all three sources. The distribution of the derived magnetic fields has a tendency to be tangential to the rim on the shell side of the sources Pup A and W28, whereas it tends to be approximately radial for the supernova remnant of A.D. 1006. (auth)

866 SEARCH FOR 5C 3 RADIO SOURCES ON 52-INCH SCHMIDT PLATES. Boerngen, F.; Bronkalla, W.; Dautcourt, G. (Zentralinstitut fuer Astrophysik, Babelsberg, Ger.). Astrophys. J.; 162: 337-9(Oct 1970).

Photographic photometry of starlike objects near 5C 3 radio sources on plates taken with the Tautenburg 52-inch Schmidt telescope yielded eight objects with colors that could qualify them as quasi-stellar sources. (auth)

867 ATTEMPT TO MEASURE THE ZEEMAN SPLITTING OF NORMAL INTERSTELLAR OH LINES. Turner, B. E.; Verschuur, G. L. (National Radio Astronomy Observatory, Green Bank, W. Va.). Astrophys. J.; 162: 341-3(Oct 1970).

An attempt to measure the Zeeman splitting of the strongly absorbed OH lines in Ori B has produced a result which indicates the presence of weak, highly polarized emission superimposed upon the absorption. Upper limits of 30 and 130 μgauss, respectively, were found for magnetic fields in the Cas A absorption lines (Perseus Arm) and for the OH emission in the dust cloud 4C. (auth)

868 ABSOLUTE MEASUREMENTS OF INTENSITY OF RADIO EMISSION FROM CASSIOPEIA-A, GYGNUS-A, TAURUS-A IN THE RANGE 3 TO 15 cm. Dmitrenko, D. A.; Tseitlin, N. M.; Vinogradova, L. V.; Giterman, Kh. F. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 823-9(1970). (In Russian).

Results are given of absolute measurements of the intensity of radio emission from Cassiopeia-A, Cygnus-A, and Taurus-A at the wavelengths of 3.2, 5.28, 7.6, 8.8, 9.7, 10, 11, 12, 13, 14, and 15 cm. Some peculiarities in the spectra are pointed out, in particular, a tendency to increasing the coefficient γ of the annual decrease of the radio emission intensity of Cassiopeia-A (at λ = 3.2 to 6 cm, $\gamma = -0.8\%$, at $\lambda = 7.3$ to 14 cm, $\gamma = -1.8\%$). The spectral index of radio emission from Cassiopeia-A at 3 to 15 cm is constant and equal to $\alpha = -0.83 \pm 0.03$, but in the spectrum of Taurus-A there is apparently a step with $\alpha \simeq 0$ in the range of 9.5 to 10 cm. (tr-auth)

869 METHOD OF RECEIVING PULSAR RADIO EMISSION. Zinichev, V. A.; Rapoport, V. O. (Gorky State Univ.). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 299-300(1970). (In Russian).

On observing pulsar radio emission at two, close, fixed frequencies, the indicating chart shows two successive pulses which are shifted in time with respect to each other. This shift is related to the dispersion in interstellar space. An expression is given for the intensity of the radio signal as a function of time at the exit of a receiver. Retardation of the radio pulses takes place with a decrease in the average frequency of the receiver. If the average frequency of the receiver is varied periodically with time, it is possible to receive each separate pulsar pulse over this period. An expression is given for finding the average frequency of the receiver suitable for reception of radio pulses over this period. With the use of this method of measurement it is possible to improve the signal-to-noise ratio by a factor of 5 to 10 on receiving signals from most pulsars. (TTT)

870 OBSERVATION OF X-RAY PULSES FROM THE CRAB NEBULA. Ducros, Georges; Ducros, Rene; Rocchia, Robert; Tarrius, Andre (CEA, Saclay, France). Compt. Rend., Ser. B; 271: 585-8(21 Sep 1970). (In French).

Definitive results concerning the pulsed x-ray flux observed in the energy range from 2.5 to 30 keV in the direction of the Crab Nebula are given. The pulses have the same period (T = 33.09297 msec) as those of the NP 0532 pulsar associated with this nebula. The percentage of pulses varies with the energy ($7.8 \pm 1.9\%$ at 4 keV and $16.8 \pm 2.7\%$ at 22 keV). This variation allows some hypotheses to be made on interstellar dust. (France)

871 DETERMINATION OF A COORDINATE OF SOME GALACTIC SOURCES OF ANOMALOUSLY EXCITED HYDROXYL. Bystrova, N. V.; Gosachinskii, I. V.; Egorova, T. M.; (and others) (Lebedev Inst. of Physics, Moscow). Dokl. Akad.Nauk SSSR; 191: 791-4(1 Apr 1970). (In Russian).

In order to determine the nature of radiation of anomalously excited hydroxyl(OH) the regions of OH radiation were correlated with various optical objects. Four sources of hydroxyl emission were studied, two sources closely coinciding with the infrared objects NML Cyg and VYC Ma and two sources associated with W49 and Sag-B2. The observed infrared objects NML Cyg and VYC Ma at 1612 MHz show that, in the increasing spectral lines, three components coincided. However, it was impossible to claim a coincidence between the OH emission region and the infrared object due to the indefinite coordinates of the latter. Observations of W49 and Sag-B2 sources at 1665 MHz were tabulated. The OH emission line in Sag-B2 showed the direct increase of the component equal to 17h 43m 53s ± 5s (1950.0). A good coincidence was observed with the northeast position of the source component in the direction of the galactic center. (R.V.J.)

872 COMMENT ON A PAPER OF I. LERCHE: EFFECT OF INTERSTELLAR DENSITY FLUCTUATIONS ON SIGNAL DISPERSION MEASURE. Elsaesser, K. (Max-Planck Institut fuer Physik und Astrophysik, Munich); Graeff, P. Astrophys. Space Sci.; 8: 204-7(Aug 1970).

The transit time of a pulsar signal is influenced by the density fluctuations of the interstellar plasma. This effect is calculated in the one-dimensional and spherically symmetrical case, using a WKB-type approximation for the transverse electric field. The influence is found to be small compared to Lerche's result, and the difference is explained by the fact that Lerche's formula refers to a "mean signal." (auth)

873 SPECTRA OF SOME DISCRETE RADIO SOURCES IN 10- TO 5000-MHz FREQUENCY RANGE. Braude, S. Ya.; Megn, A. V.; Ryabov, B. P.; Zhouck, I. N. (Inst. of Radiophysics and Electronics, Kharkov). Astrophys. Space Sci.; 8: 275-322 (Aug 1970).

On the basis of absolute measurements in the 12.6 to 25-MHz frequency range and the relative measurements at frequencies 750, 1400, 2695, and 500 MHz (NRAO) and 408, 1410, and 2650 MHz (Parkes), 57 standard spectra were obtained that are linear (on a log−log scale) in the range 12.6 to 5000 MHz. The comparison of the flux densities presented in the surveys at 10.03, 22.25, 26.3, 38, 86, and 178 MHz and the standard spectra was carried out and thus the correction coefficient was calculated. It is shown that the scale of absolute fluxes CKL on the frequencies 38 and 178 MHz is lowered on 28% and 8%, respectively. The possible sources of divergences of the results of measurements in decametric wavelength are discussed. Making use of the corrected data at 38 MHz and 178 MHz, of the results at higher frequencies mentioned above, and of the original results of measurements in the 12.6 to 25 MHz range, the spectra of 55 discrete sources were constructed. The spectra of 149 sources were also obtained on the basis of the surveys at 10.03, 22.25, 26.3, 38, and 178 MHz corrected according to standard spectra. (auth)

874 POLARIZATION OF PULSAR RADIATION. Manchester, R. N. (National Radio Astronomy Observatory, Green Bank, W. Va.). Nature (London); 228: 264-6(17 Oct 1970).

The polarization of radiation from four pulsars (PSR 1133 + 16;

1237 + 25, 2022 + 51; 2045 – 16) was measured and interpretations of the results are suggested. (auth) (UK)

875 PRECISE RADIO SOURCE POSITIONS: COMPARISON OF TWO INDEPENDENT LISTS. Wade, C. M. (National Radio Astronomy Observatory, Green Bank, W. Va.); Gent, H.; Adgie, R. L.; Crowther, J. H. Nature (London); 228: 146-7 (10 Oct 1970).

Comparisons are made between measurements made at Green Bank and at the Royal Radar Establishment, Great Malvern, Eng. Both sets of observations were made by interferometry at a nominal frequency of 2,695 MHz, but the actual methods employed differed radically. The measured positions for 28 sources common to the two lists were generally in excellent agreement. Measurements at Green Bank were made with a three-element interferometer, whereas those at RRE were made with a two-element interferometer. The close grouping of the two sets of measurements in declination is considered to be an important result, as it shows that measurements based on a sufficient number of optical calibrators (RRE) can give satisfactory agreement with absolute measurements (Green Bank). The standard errors were significantly better than 1 arc sec. (UK)

876 ABSORPTION LINES IN QUASI-STELLAR OBJECTS WITH $z_{abs} > z_{em}$. Williams, R. E. (Univ. of Arizona, Tucson). Nature (London); 228: 269-70(17 Oct 1970).

Of the 25 QSOs known to show absorption lines, six have absorption lines with larger redshifts than the corresponding emission lines, and it has been suggested that absorption lines in QSOs originate in clouds of gas ejected from the QSO as a result of outbursts. The lines having $z_{abs} > z_{em}$ are then interpreted as resulting from clouds which have an inward velocity that exceeds the mean outward motion of the system of clouds. In spite of the extremely large velocity dispersion required to bring about this situation it is conceivable that it might occasionally occur, but the relatively common occurrences of lines for which $z_{abs} > z_{em}$ suggests that the assumption that the usual state of a QSO is one in which matter is flowing outward may not be entirely valid. Possible causes of the high inward velocities are discussed, and it is considered doubtful if any explosion or ejection effect would directly accelerate the gas inward. It is proposed that the high inward velocities are caused by the acceleration of gas due to the gravitational attraction of a large central mass. If this interpretation is correct the lower limit to the mass of a QSO can be obtained. It is considered that the absorption lines for which $a_{abs} > z_{em}$ should be studied carefully to detect possible changes in either line width or redshift with time, since the time scale of such variations may lead to estimates of the masses for the QSOs. Observations suggest that the gas associated with QSOs is accreted by gravitation and then expelled by some mechanism such as particle pressure. If this interpretation is correct the need to postulate the creation of matter in the center of QSOs is lessened. (UK)

877 UNIDENTIFIED INTERSTELLAR MICROWAVE LINE. Buhl, D. (National Radio Astronomy Observatory, Green Bank, W. Va.); Snyder, L. E. Nature (London); 228: 267-9(17 Oct 1970).

It is stated that during a search for $H^{12}C^{14}N$ and $H^{13}C^{14}N$ a new molecular line was detected. This observation was made in June 1970 with the 36-ft telescope at Tucson, Arizona, using a 3-mm mixed radiometer receiver, and covering frequencies of 85 to 90 GHz. Details of the technique adopted are given. This line could not be positively identified and is referred to as the X-ogen line. In determining the rest frequency of this line comparisons were made with HCN and CO observations. The frequency was determined as 89, 190 ± 0.002 GHz, which is 560 MHz higher than the $H^{12}C^{14}N$ ($1 \rightarrow 0$) transition. Possible origins of the line are discussed. It is thought possible that the main molecular isotope of X-ogen was not detected, adding to the identification problem. Higher resolution spectra are needed to aid the identification, and mapping is necessary to learn the spatial extent of the X-ogen emission and to check for anomalous emission. (UK)

878 CORRELATION OF THE AMPLITUDE OF SUCCESSIVE PULSES OF CP 0328. Shuter, W. L. H.; McCutcheon, W. H. (Univ. of British Columbia, Vancouver). Nature (London); 227: 1331-3(26 Sep 1970).

A study of the amplitude variation of individual pulses of 26 pulsars was undertaken on June 29–31, 1970, using the 46-m antenna at Algonquin Radio Observatory. The system specifications were: RH circular polarisation, center frequency 408 Mhz, bandwidth 4 MHz. Only CP 0328 showed sufficiently intense pulses to warrant further analysis. The analysis consisted of determinations of the auto-correlation function and power spectrum for a number of batches of 250 pulses. No evidence was seen for any significant second periodicity in the pulsar data. A significant difference from the results of earlier investigations (Nature 223: 797(1969)) was that the data showed high correlation at a shift of one pulse period, whereas the random numbers used to simulate random intensity variations of a pulsar, as expected, showed insignificant correlation. At a shift of two or more pulse periods the correlation was insignificant. Some possible explanations of the correlation in amplitude of adjacent pulses are advanced, and two models are proposed referring to conditions near the pulsar, assuming the oblique rotator model; these models could be distinguished only by further observations of several other pulsars, and such observations would be of great value for attempts to evaluate the details of the radiation mechanism. (UK)

879 EXTRAGALACTIC VARIABLE RADIO SOURCES. Rees, M. J. (Inst. for Advanced Study, Princetown, N. J.); Simon, M. Nature (London); 227: 1303-6(26 Sep 1970).

Clues to the origin of the enormously energetic activity in quasars and galactic nuclei may come from observations of the varying radio emission from several objects outside the Galaxy. The varying signals from these objects often seem to come from areas which are only a few light months in diameter. (auth) (UK)

880 PULSAR NP 0532: POLARIZATION OF STRONG PULSES AT 430 MHz AS SEEN WITH 300 kHz BANDWIDTH. Rankin, J. M. (Univ. of Iowa, Iowa City); Heiles, C. Nature (London); 227: 1330-1(26 Sep 1970).

Reference is made to some recent studies on this topic (Nature 225: 526 and 226: 529(1970)), in which large linear polarizations were found but it was not known which pulse component was responsible for the strong pulses, although the precursor was suspected because of its high average linear polarization. The present authors measured systematic circular polarization in the strong main pulses and propose that the differences in earlier results might have been due to the difference in observing bandwidth (330 and 10 kHz). The experimental work was repeated and it was found that the typical pulse appeared to be less strongly polarised and that strong pulses arise from the main pulse component; the studies were made using the Arecibo telescope and the 430-MHz dual circularly polarised line feed. The observations were made on March 12, 1970. (UK)

Solar Phenomena

Refer also to abstracts 1029 and 1244.

881 (AD-707102) SOLAR COSMIC RAYS. Dorman, L. I.; Miroshnichenko, L. I. Translated by Robert Wallace from pp 82-185 of Solnechnye Kosmicheskie Luchi, Moscow, 1968. 151p. (FTD-MT-24-12-70). NTIS.

The book represents a systematic organization and analysis of general experimental material on solar cosmic rays that was obtained in the period 1942–1967 by means of surface apparatus for continuous recording of cosmic rays (neutron monitors, ionization chambers, counter and scintillation telescopes) and also from data obtained by stratospheric, satellite, and rocket measurements. The basic attention is concentrated on questions of the generation and propagation of solar cosmic rays. The question of the shape and appearance of energy spectra of solar particles (the power and exponential function of hardness) is considered in detail, and the dependence of the diffusion coefficient on particle energy and distance to the Sun is discussed. A special chapter is concerned with certain problems in the physics of solar flares and the generation of cosmic rays on the Sun. In particular, the possibility of predicting flares that will emit powerful fluxes of energetic solar particles is discussed. A separate section is concerned with problems of protecting cosmonauts from solar-flare protons during space flights. Certain experimental and theoretical problems for future study of solar cosmic rays are enumerated. (auth) (USGRDR)

882 (AD-707486) STRUCTURE AND DEVELOPMENT OF A SUNSPOT GROUP ON JULY 4–8, 1966. Steshenko, N. V. Translated for Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass., from Ivz. Krym. Astrofiz. Observ.; 39: 245-52(1969). 16p. (AFCRL-70-213; AFCRL-Trans-74). NTIS.

The structural peculiarities of a group of sunspots during its growth were investigated on the basis of photoheliograms obtained with high resolution. The group was characterized by the complex structure and rapid change in the umbrae of the sunspots. A comparison of the position of filaments of the penumbra with the charts of the transverse magnetic field obtained by Severnyi and Tsap showed generally good agreement in the orientation of the filaments and the field. This was an additional confirma-

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tion of the fact that an investigation of the fine structure of spots from direct photographs of the Sun can give supplementary information on the structure and evolution of the strong magnetic field. (auth) (USGRDR)

883 (AD-709205) CORRELATION BETWEEN SOLAR X-RAY LINE EMISSION AND SOLAR-RADIO EMISSION. Report for June 1969–April 1970. Rugge, Hugo R.; Walker, Arthur B. C. Jr.; Anderson, M. (Aerospace Corp., El Segundo, Calif.). 15 Jul 1970. Contract F04701-70-C-0059. 23p. (TR-59(9260-2)-1; SAMSO-TR-70-259). NTIS.

The intensities of a number of solar x-ray emission lines in the 8- to 25-A region were compared to solar radio emissions at several wavelengths to search for a correlation between the two and to try to identify a slowly varying component of the x-ray emission lines. The x-ray measurements were made from the OV1-10 satellite from December 1966 to June 1967 with a Bragg crystal spectrometer. The radio measurements at six frequencies between 606 and 8800 MHz were taken from reports in the literature. In general, the highest correlation coefficients (r is about 0.80) occur at the longer radio wavelengths for the shortest x-ray wavelengths, and the shorter x-ray wavelengths correlate best with the shortest radio wavelengths. The high correlation coefficients obtained strongly suggest a close relationship between the radio and x-ray emissions. These highly correlated x-ray and radio emissions are referred to as the slowly varying component. The same active regions appear to be responsible for both the radio and x-ray emissions. (auth) (USGRDR)

884 (N-70-29888) HIGH-RESOLUTION X-RAY IMAGES OF THE SUN USING A GRAZING INCIDENCE TELESCOPE FROM A SOLAR POINTING AEROBEE ROCKET. Final Report, April 1968–March 1970. Davis, J.; De Caprio, A.; Haggerty, R.; Krieger, A.; Manko, H.; (and others) (American Science and Engineering, Inc., Cambridge, Mass.). 30 May 1970. Contract NASw-1700. 75p. (NASA-CR-110354; ASE-2438). NTIS.

Flight film obtained from an Aerobee 150 rocket on March 15, 1968 was analyzed and a high-resolution grazing-incidence x-ray telescope system flown on June 8, 1968 was calibrated, tested, and aligned. The x-ray flux for the whole Sun was determined and x-ray flares in the active region were recorded. The central core of the x-ray region is correlated to the H-alpha image of the Sun. (STAR)

885 (N-70-35279) SOLAR-WIND COMPOSITION EXPERIMENT. Geiss, J.; Eberhardt, P.; Signer, P.; Buehler, F.; Meister, J. (Bern Univ. (Switzerland). Physikalisches Institut). 1 Jun 1970. 4p. NTIS.

A 30 cm × 140 cm aluminum foil was exposed to the solar rays on the lunar surface for 18 hr 42 min and returned to Earth for analysis. The ^{4}He concentration was determined to be $\sim 45 \times 10^{10}$ atoms/cm^2, the ^{4}He/^{3}He ratio to be about 2600, and the average ^{4}He flux to be about 8.2 million atoms/cm^2-sec. The results also indicate that fluxes and isotopic composition can be obtained for neon and argon for larger foil areas. (STAR)

886 SOLAR WIND EVENT OF JANUARY 2, 1970. Genesio-Elgarten, V.; Joukoff, A. A. (Univ. Libre, Brussels). Solar Phys.; 14: 234-7(Sep 1970).

A discontinuity in the solar wind energy and angular distribution on January 2, 1970, probably associated with the flare of December 30, 1969, is shown from experiment S58 in HEOS-1. (W.D.M.)

887 STABILITY OF TANGENTIAL DISCONTINUITIES. Northrop, T. G.; Birmingham, T. J. (Goddard Space Flight Center, Greenbelt, Md.). Solar Phys.; 14: 226-33(Sep 1970).

The MHD stability of tangential discontinuities is first considered. These discontinuities are treated as structured forms rather than as sharp breaks in the magnetic field. An unfamiliar form of the MHD energy principle is applied, and stability is proved provided that there is no fluid flow tangent to the "discontinuity" plane. Perturbations which simply transform the system from one equilibrium to another are neutrally stable. Using comparison theorems it is concluded that the observed stability of tangential forms in the solar wind implies near isotropy of the particle pressure in them. (auth)

888 SOLAR ACTIVITY AT $\lambda = 15.8$ mm (19 GHz) DURING THE PERIOD OCTOBER 27–NOVEMBER 4, 1968 AND ITS RELATION TO PROTON EVENTS. Croom, D. L.; Powell, R. J. (Science Research Center, Slough, Eng.). Solar Phys.; 14: 221-5(Sep 1970).

Four 15.8 mm solar bursts are discussed and the results are compared with data on recorded proton events, in relation to the prediction of such events from radio observations. (auth)

889 Hα CORONAGRAPH OBSERVATIONS OF A FLARE SPRAY, MARCH 1, 1969. McCabe, Marie K.; Fisher, R. R. (Univ. of Hawaii, Honolulu). Solar Phys.; 14: 212-20(Sep 1970).

An Hα solar prominence with the characteristics of a spray was ejected in association with a bright limb flare. Knots of material were observed to a distance of more than one solar radius above the west limb of the Sun. The optical event was followed by 80 MHz emission from a Type IV source which was observed moving out through several solar radii. Coronagraph observations have been used to determine the trajectories and velocities of the knots in directions perpendicular to the line of sight. After some early deceleration, velocities increase to 300 to 500 km/sec and slowly decline with variations depending on the initial direction of outflow. It is suggested that the magnetic field over the spot group is deformed by the energy of the mass motions of material fragments, some of which then continue to move outward from the Sun. (auth)

890 DETERMINATION OF THE VELOCITY OF THE EXCITERS OF TYPE II SOLAR RADIOBURSTS. Van Bueren, H. G.; Kuperus, M. (Univ. of Utrecht). Solar Phys.; 14: 208-11(Sep 1970).

Under the assumption that Type II bursts are excited by strong shock waves it is shown that the velocity determined from dynamic spectrograms should be corrected by a term proportional to the gradient of the shock strength. The magnitude of the correction strongly depends on the properties of the pre-shock atmosphere and the geometry of the shock propagation. (auth)

891 POLARIZATION OF THE EMISSION OF X-RAY SOLAR FLARES. Tindo, I. P.; Ivanov, V. D.; Mandel'stam, S. L.; Shuryghin, A. I. (Lebedev Inst. of Physics, Moscow). Solar Phys.; 14: 204-7(Sep 1970).

X-ray polarization measurements on three flares which occurred in October 1969 were performed by means of a Thomson scattering type instrument installed on board the satellite Intercosmos-1. The polarization (P) at the wavelength of about 0.8 Å was detected at the rising phase and at the second maximum of intensity. The averaged value of P for all three flares was 0.4 ± 0.2 at confidence level 0.9. (auth)

892 STRONG CORONAL SHOCKS AND THERMAL SOLAR X-RAY BURSTS. Hyder, Charles L. (Sacramento Peak Observatory, Calif.). Solar Phys.; 14: 196-203(Sep 1970).

It is found that a one-dimensional strong coronal shock ($M_s \geq 3$) will grow outward until the Mach number (M_s) ceases to increase with height ($dM_s/dh = 0$). The shock is driven by the pressure gradient and it is damped by gravity and by energy losses (radiative and conductive). The driving and damping terms reach equilibrium for $M_s \simeq 4$. Standard shock jump conditions for $M_s \simeq 4$ lead to post-shock temperatures in the corona in the range 10^7 to 1.8×10^7 K and emission measures from 3.8×10^{47} to 3.8×10^{48} cm^{-3}. For isolated simple events, an exponential decay of the emission measure with decay times in the range $1 \leq \tau \leq 6.5$ min is predicted. In a detailed study of over 4000 x-ray bursts, Drake (1970) compares 1 to 6 keV x-ray data with 7.7 to 12.5 keV x-ray data (the "thermal" component) and finds ranges for the temperatures of 1.2×10^7 to 1.8×10^7 K, for the emission measures of 5.1×10^{47} to 3.8×10^{48} cm^{-3} and for the decay times $0.5 \leq \tau \leq 20$ min. He also finds that the emission measure varies "... both from event to event and within the event, by more than a factor of two." The agreement between the predictions and the observations makes it appear that a strong shock in the corona will produce a post-shock state that yields the observed characteristics of the soft component of x-ray bursts (the "thermal" x-rays). Several examples are given where sprays and fast eruptive prominences ($M \leq 1$), that are not associated with solar flares, are associated with "thermal" x-ray bursts. There were two slow eruptive prominences ($M \ll 1$) in the sample, and neither of them yielded a detectable x-ray burst. (auth)

893 POLARIZATION CHANGES WITH TIME DURING SOLAR MICROWAVE IMPULSIVE BURSTS. Kaufmann, Pierre; Matsurra, Oscar T.; Marques Dos Santos, O. (Mackenzie Univ., Sao Paulo, Brazil). Solar Phys.; 14: 190-5(Sep 1970).

The evolution with time of circular polarization $\pi(t)$ from solar bursts at 7 GHz presents, in the majority of cases, a polarization degree peak before the maximum flux time. The subsequent evolution of $\pi(t)$ is continuous and usually increasing. The changes could be caused by superimposed polarization effects, due to the fast emissive electrons (dominant in the first phase), and to the propagation effects caused by the coronal condensation where the event occurred (dominant in the second phase). In an approximate approach, $\pi(t)$ is connected to the movement of the source in the second phase, being qualitatively sound, but limited to the lack of knowledge on acceleration processes and on magnetic-field topology in the active region where the flares take place. (auth)

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894 SOLAR RADIO SPECTRA BETWEEN 160 AND 320 MHz. De Groot, T. (Astronomical Inst., Utrecht). Solar Phys.; 14: 176-89(Sep 1970).

Dynamic spectra of incremental solar radio emission reveal that (mostly faint) pulsating and morphologically similar structures, including patterns of "bright spots", dominate between ca. 250 and 320 MHz. As "individual bursts" these bright spots are similar to Type I bursts but they appear in an entirely different environment. This kind of activity is indicative of Type IV emission and seems to favor the generation of Type III bursts. Often its boundary with storm activity at the lower side of the band is rather sharp. (auth)

895 RADIO MAPS OF THE SUN AT $\lambda = 1.95$ cm. Drago, Franca Chiuderi (Inst. for Space Studies, New York); Felli, Marcello. Solar Phys.; 14: 171-5(Sep 1970).

Two radio maps of the Sun at $\lambda = 1.95$ cm, taken at Green Bank with a resolving power of 2.1 are studied and compared with Hα pictures: both bright and dark features appear to be strongly correlated. The emitted flux and the angular extent of the bright regions are given; from the observed radio-darkening of a region, the height of a prominence is derived. (auth)

896 COMMENTS ON A PAPER BY H. ZIRIN ENTITLED: CORONAGRAPH OBSERVATIONS OF THE CORONAL CONDENSATION OF 4 FEBRUARY 1962. Billings, Donald E. (Univ. of Colorado, Boulder). Solar Phys.; 14: 168-70(Sep 1970).

Zirin (Solar Phys. 11, 497(1970)) presented ion-abundance curves for iron at various limb positions inside and outside the intense coronal condensation of Feb. 4, 1962. Because of the observation that these curves have about the same shape at all limb positions studied, he suggests that coronal condensation is a dynamic process in which the atoms are ionized to a very high state, then are observed in their various stages of ionization as they recombine. This process is questioned. (W.D.M.)

897 DEPENDENCE OF THE DURATION OF THE ZONAL SPOT ACTIVITY ON THE SOLAR ROTATION. Gleissberg, W. (Univ., Frankfurt am Main). Solar Phys.; 14: 166-7(Sep 1970).

Recently Kopecky (1970) established a relation between D, the duration of the zonal spot activity, and ξ, the daily angle of the solar rotation. Kopecky stated that D and ξ are connected with one another by the following relation: $D \sim \xi$, provided that only values of D and ξ for $\varphi > 10°$ are taken into consideration. A slight modification to this statement is considered. (W.D.M.)

898 SPECTRUM OF MULTIPLY IONIZED IRON BETWEEN 10 AND 17 A. Connerade, J. P. (European Space Research Inst., Frascati, Italy); Peacock, N. J.; Speer, R. J. Solar Phys.; 14: 159-65(Sep 1970).

Valency- and inner-shell transitions in multiple ionized iron were excited in the transient pinch of a "plasma focus" discharge. Hartree–Fock calculations were made to identify the levels involved and a comparison was made with observations of solar flares. (auth)

899 SEARCH FOR THE K-LINE OF Ca II DURING THE ECLIPSE OF MARCH 7, 1970. Evans, Charles D. (Kitt Peak National Observatory, Tucson, Ariz.). Solar Phys.; 14: 157-8 (Sep 1970).

At the Mar. 7, 1970 eclipse, there were no significant differences between intensity levels between K-line and H line, nor were there any finely structured features in the upper atmosphere of the Sun in Hα larger than 2.5". The two Hα features close to the limb, though unexpected, did not appear to be remarkable. (W.D.M.)

900 Hα DOPPLER BRIGHTENING AND LYMAN-α DOPPLER DIMMING IN MOVING Hα PROMINENCES. Hyder, Charles L.; Lites, Bruce W. (Air Force Cambridge Research Labs., Sunspot, N. Mex.). Solar Phys.; 14: 147-56(Sep 1970).

The effect that coherent motion has on the observed brightness of moving clouds above the photosphere is considered, and it is found that steady-state clouds (constant N_e and T_e) that are moving perpendicular to the line of sight will appear brighter in Hα for speeds between 8 and 100 km/sec and dimmer for speeds greater than 135 km/sec. The brightening and dimming are due to apparent Doppler shifts of the respective Hα absorption and the Lyman-α emission profiles "seen" by the absorption profile of the moving cloud. This analysis is applied, along with optical depth and geometrical considerations, to the observed brightness variations of the March 1, 1969 limb eruptive prominence. It is found that all of the observed brightening and dimming can be explained by the motions, and that no significant change in the prominence N_e or T_e was necessary during the observed Hα event. This conclusion is significant in interpreting an x-ray burst that began as the prominence velocity increased abruptly at the time of maximum Hα intensity. The "thermal x-ray" peak occurred 150 sec later when the prominence had become faint again. There was no associated flare that was visible in Hα. The relative brightness of Hα and D_3 in a specific moving prominence knot is discussed. It is noted that the observed range of limb speeds (30 to 150 km/sec) may be due to the combined Hα Doppler brightening and Lyman-α dimming effects. The Hα brightness of disk surges (bright and dark) and flares, and sprays and puffs that occur at or near the limb, are discussed. (auth)

901 ELECTRIC CONDUCTIVITY IN THE INHOMOGENEOUS PHOTOSPHERE AND SUNSPOTS. Kopecky, M. (Astronomical Inst., Ondrejov, Czech.). Solar Phys.; 14: 136-7(Sep 1970).

An attempt is made to determine the electric conductivity of cold and hot components of the photosphere and sunspots and to estimate the consequences of different conductivity. (W.D.M.)

902 MOTION OF PENUMBRA FILAMENTS IN SUNSPOTS. Abdusamatov, H. I.; Krat, V. A. (Pulkovo Observatory, Leningrad). Solar Phys.; 14: 132-5(Sep 1970).

The spectrum of the penumbra of a large sunspot was selected from a series of spectrograms obtained on June 14, 1969 at Pulkovo under good seeing conditions. The radial velocities relative to the undisturbed photosphere of separate penumbra features were measured at the "gravity" centers of the line profiles for λλ 4331.651 Ni, 4337.925 Ti II, 4344.290 Ti II, 4346.295 CH, 4348.947 Fe, and 4351.056 Cr. (W.D.M.)

903 SELF-REVERSAL OF THE LITHIUM RESONANCE DOUBLET IN SUNSPOTS. Maltby, P.; Engvold, O. (Univ. of Oslo). Solar Phys.; 14: 129-31(Sep 1970).

Excellent sunspot spectra of the wavelength region 6610 to 6775 were obtained at the Oslo Observatory on Mar. 21 and 22, 1969. From nine spectra, including the Li I 6708 doublets, an average line depth at 6707.8 of 0.75 was found, considerably deeper than the 0.5 value estimated by previous observers. (W.D.M.)

904 ZEEMAN SPLITTING OF MOLECULAR LINES IN SUNSPOT SPECTRA. Mallia, E. A. (Oxford Univ.). Solar Phys.; 14: 125-8(Sep 1970).

The presence of magnetic splitting in a line of MgH (first discovered by Wöhl) was confirmed by photoelectric observations. The umbral magnetic field deduced from the line splitting was 3150 ± 200 G against 2360 ± 200 G given by FeI λ5250. This difference is opposite in sign to that found by Wöhl. Lines from the $B^2\Sigma - X^2\Sigma$ transition of CaH are also shown to be broadened by Zeeman splitting. (auth)

905 MULTI-CHANNEL MAGNETOGRAPH OBSERVATIONS. II. SUPERGRANULATION. Frazier, Edward N. (Aerospace Corp., El Segundo, Calif.). Solar Phys.; 14: 89-111(Sep 1970).

The Kitt Peak multi-channel magnetograph was used to make raster scans of the supergranulation. The region scanned was carefully selected to be quiet and was located at the center of the disk. Each point in the raster was observed twice (with a time interval of 150 sec) and averaged, thereby cancelling out effects of the 5 min oscillations. Subsequent raster scans were made over a period of 4 h and averaged, further reducing short-lived, nonperiodic modes and enhancing the long-lived supergranulation. The results clearly show vertical supergranular motions. These motions consist of relatively isolated "patches" of downward flowing material, or "downdrafts," with a speed of approximately 0.1 km/sec. These downdrafts are highly correlated with patches of magnetic field, being not only cospatial with them but also approximately linearly proportional to the field strength. The magnetic field strength of these downdrafts is in the range from 50 to 100 G. These downdrafts are also regions of increased temperature (i.e., brighter than average) at all levels observed, from the Ca II K line down to the level of the continuum. The observations show no contradiction with the hypothesis that the supergranulation is a convective phenomenon, but they do indicate that the convection would be far more complicated than previously supposed. In particular, the surprisingly large field strengths and the presence of a bright network at all levels suggest that the magnetic field plays a far more active role in the supergranulation. (auth)

906 CONCERNING THE FORMATION OF GIANT REGULAR STRUCTURES IN THE SOLAR ATMOSPHERE. Bumba, V. (Astronomical Inst., Ondrejov, Czech.). Solar Phys.; 14: 80-8(Sep 1970).

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Using the Mt. Wilson magnetic synoptic charts from the recent solar activity cycles the dynamics of the formation of giant regular structures formed in the plus (leading) polarity of older more extended magnetic fields are studied. Although their diameters are about one order greater than those of supergranules, the processes of their development go analogously to those of supergranulation and granulation. The close relation of the minus (following) polarity distribution to the new formed active regions is demonstrated and the possible different mode of distribution and different role of both opposite polarities on activity processes is discussed. (auth)

907 FREQUENCY DEPENDENCE OF ACOUSTIC EMISSION BY ISOTROPIC TURBULENCE. Milkey, Robert W. (Los Alamos Scientific Lab., N. Mex.). Solar Phys.; 14: 77-9(Sep 1970).

The physical interpretation of the frequency behavior calculated by Stein (1967, 1968), for acoustic emission by isotropic turbulence in a stratified medium is extended. Stein found that the acoustic flux transmitted to the solar chromosphere reached a peak at a relatively high frequency, that is much higher than the gravitational cutoff frequency. This result is an apparent contradiction to earlier results (e.g. Parker, 1965), based on the extension of the results for a uniform medium (Meecham and Ford, 1958), which indicated that no such peak should occur. An attempt is made to identify and explain the source of this apparent contradiction. It is shown, in agreement with Stein's assertion, that the general features of the frequency dependence found by Stein are explainable in terms of the results for a uniform medium, and the important role of the parameters specifying the frequency of the largest turbulent eddy in determining the shape of the acoustic emission spectrum is identified. (W.D.M.)

908 CHROMOSPHERIC HEATING ABOVE SUPERGRANULAR BOUNDARIES. Milkey, Robert W. (Indiana Univ., Bloomington). Solar Phys.; 14: 62-76(Sep 1970).

A geometrical optics technique developed in order to study energy transport by weak fast-mode hydromagnetic shock waves in a nonhomogeneous, anisotropic medium was applied to the problem of the heating of the chromosphere in the regions of intensified magnetic field which occur above the boundaries of supergranular cells. The results of the calculation indicate that there should be a temperature enhancement in the regions of the chromospheric network. This temperature enhancement is advanced as a possible mechanism for the origin of the observed calcium emission network. (auth)

909 CONVECTIVE INSTABILITY OF A MODEL CHROMOSPHERE. Defouw, Richard J. (Carnegie Institution of Washington, D. C. California Inst. of Tech., Pasadena). Solar Phys.; 14: 42-61(Sep 1970).

The convective stability of a simple model chromosphere is investigated. The model chromosphere consists of protons, electrons, and hydrogen atoms in the ground state; ionization is collisional and recombination is radiative. The analysis indicates stability when the kinetic temperature (T) is less than 17,500 K (assuming T increases with height). However, for T > 17,500 K, the model chromosphere is overstable in the absence of magnetic fields provided the temperature inversion is sufficiently steep. For smaller values of the temperature gradient, field-free regions are stable if the density is small and monotonically unstable if it is large. In the presence of a magnetic field, the model chromosphere is monotonically unstable for T > 17,500 K, regardless of the temperature gradient. The convective instability of the model chromosphere results from the fact that the plasma is thermally unstable for T > 17,500 K. Thermally unstable regions of the solar atmosphere, although not represented in detail by the model, should behave in a similar fashion. Field-free regions of the solar chromosphere are probably not monotonically unstable, but overstability is possible and may explain the origin of chromospheric oscillations with periods less than 200 sec. It is suggested that spicules result from the monotonic instability of magnetic regions. A similar instability in the corona may be responsible for the large Doppler spreading of radar echoes. Elementary considerations of thermal balance predict that the temperature gradient should diverge at levels of marginal stability. The chromospheric region of spicule formation and the corona should therefore both be bounded below by abrupt temperature jumps. (auth)

910 SOLAR LIMB EMISSION SPECTRUM BETWEEN 300 AND 2803 A. Burton, W. M.; Ridgeley, A. (Culham Lab., Abingdon, Eng.). Solar Phys.; 14: 3-28(Sep 1970).

The spectrum of the solar limb was recorded in the wavelength region 300 to 2803 Å using instrumentation carried in "Skylark" rockets. More than 600 emission lines were observed of which about 500 have firm identifications, while 50 lines remain unidentified. A complete list of observed emission lines is given together with estimated line intensities and comments on the identifications. (auth)

911 CENTER–LIMB OBSERVATIONS OF INHOMOGENEITIES IN THE SOLAR ATMOSPHERE. I. THE Mg b LINES. Cannon, C. J.; Wilson, P. R. (Univ. of Sydney). Solar Phys.; 14: 29-41(Sep 1970).

Center–limb observations of line-center intensity and velocity fluctuations in the magnesium b lines are described. Autocorrelation and power spectral analyses indicate small scale brightness structures having periodicities of 3000 and 8000 km and large scale structures of 22,000 km. Corresponding velocity structures are 6,000 and 30,000 km. The relative rms fluctuation amplitude for the small-scale bright features is found to be of order 12% and for the large scale features 8%. The variation of these rms values with heliocentric angle is also shown. At disk center some weak correlation is found between bright features and downward velocities in the large scale structures. Towards the limb there is a strong correlation in all three lines between line of sight motions and bright features. This indicates that the large scale bright features are closely associated with the supergranule motions. By inspecting the actual brightness and velocity fluctuation tracings it can be seen that, in some regions, the small scale structures show a significant negative correlation over a range of about 25,000 km. Beyond this characteristic length, however, the correlation may decrease abruptly or even become positive for a similar distance. There is some evidence which suggests that this behavior may also be related to the supergranule motions. (auth)

912 CALCULATION OF THE RADIATION HAZARD AT SUPERSONIC AIRCRAFT ALTITUDES PRODUCED BY AN ENERGETIC SOLAR FLARE. II. Armstrong, T. W.; Moran, H. S. (Oak Ridge National Lab., Tenn.). Nucl. Sci. Eng.; 42: 41-8(Oct 1970).

Calculations were carried out to estimate the absorbed-dose and dose-equivalent rates at various depths in the atmosphere produced by an energetic solar flare—the flare of February 23, 1956. The dose rates were determined both by computing flux spectra using air only and applying flux-to-dose conversion factors and by computing the dose rates in tissue using an air–tissue–air arrangement. The two methods of calculation were in reasonable agreement when the flux-to-dose factors were applied to the forward-flux spectra, but the calculations indicated that previous results obtained using omnidirectional-flux spectra overestimate the dose rates. Also, the effect of the fuel carried by a supersonic aircraft on the dose received by the passengers in the event of a solar flare was considered and found not to be substantial. (auth)

913 SOLUTION OF ONE-FLUID EQUATIONS WITH MODIFIED THERMAL CONDUCTIVITY FOR THE SOLAR WIND. Cuperman, S.; Harten, A. (Tel-Aviv Univ., Israel). Cosmic Electrodyn.; 1: 205-17(Sep 1970).

The possibility is investigated of extending the agreement between the one-fluid solutions and the observed characteristics of the solar wind so as to include the recently measured anomalously low electron heat conduction at 1 AU. The one-fluid equations for the supersonic solar wind are numerically solved for a wide variety of conditions. It is shown that it is not possible to lower the predicted electron heat conduction at 1 AU by varying the coronal base conditions without affecting the other characteristics of the solar wind. When a "reduced" thermal conductivity is used in the one-fluid equations, a significant decrease in the electron heat conduction at 1 AU is obtained without affecting agreement of the other characteristics of the solar wind with observed values. With a thermal conductivity whose numerical coefficient is the ordinary collisional one to a distance of 15 solar radii followed by a monotonic decrease (whose rate is determined by the requirement that at 1 AU the numerical coefficient have half its value at 15 $R_\odot$) and with the base conditions (at 1 $R_\odot$) $n = 2.65 \times 10^8$ cm^{-3} and $T = 1.33 \times 10^6$ K, one obtains: $n = 6.3$ cm^{-3}, $v = 258$ km/sec, $T = 1.8 \times 10^5$ K and an electron heat conduction of 1.8×10^{-2} erg cm^{-2} sec^{-1} at 1 AU. The observed electron thermal energy flux at 1 AU is $\sim 1.5 \times 10^{-2}$ erg cm^{-2} sec^{-1}. The consequences of these results are discussed. (auth)

914 CONDITIONS FOR COSMIC GRAIN FORMATION. Lehnert, B. (Royal Inst. of Tech., Stockholm). Cosmic Electrodyn.; 1: 218-32(Sep 1970).

The balance of matter and heat is investigated for cosmic grains being exposed to radiation and being surrounded by a plasma or a neutral gas. The grains are able to increase their mass only within certain ranges of density and temperature of the surrounding gas,

of the radiation intensity, and of the physical properties of matter. The results are summarized as follows: (i) Grains consisting of different elements or chemical compounds differ strongly in their behavior. (ii) Grains of certain elements or compounds should be absent in interplanetary matter within certain regions of the solar system. (iii) The conditions obtained put certain limits on the density, temperature, and the degrees of dissociation and ionization of the gas out of which grains can condense to form the precursors of planets during the formation of the solar system. Corresponding limits are also placed on the intensity of solar radiation. This provides a method of estimating the solar radiation and the gas densities during the development of the solar system. (iv) The conditions deduced for grain balance should in principle apply to any gas composition. However, in detailed calculations of grain condensation of chemical compounds, the equivalent evaporation rates, sticking probabilities and other pertinent physical data have to be determined. This requires further investigations beyond the scope of this paper which only gives a few simplified examples to illustrate the mechanism of grain balance. (auth)

915 REVERSE HYDROMAGNETIC SHOCK IN THE SOLAR WIND. Burlaga, L. F. (Goddard Space Flight Center, Greenbelt, Md.). Cosmic Electrodyn.; 1: 233-8(Sep 1970).

A reverse hydromagnetic shock in the solar wind is identified. The shock surface is oriented along the spiral direction, and it separates a high speed stream from a compressed, anomalously hot plasma ahead of the stream. (auth)

916 EFFECT OF INTERPLANETARY SHOCK WAVES ON THE BRIGHTNESS OF COMETS. Eviatar, Aharon; Joseph, Joachim H.; Dryer, Murray (Tel-Aviv Univ., Israel). Cosmic Electrodyn.; 1: 239-51(Sep 1970).

A physical model is proposed to explain the phenomenon of brightness variations or "flares" in Schwassmann–Wachmann I and other comets on a time scale of hours. Platt particles are assumed to exist in the dust cloud surrounding the nucleus. Normally, they are shadowed by the dust, but if a solar-flare-generated shock wave impinges on the comet, sufficient energy can be imparted to the particles, whose mass is small compared to that of dust particles, to drive them to the rim of the comet. Their high visible albedo causes them to appear as a bright reflecting expanding shell. The observed asymmetry and absence of polarization are explained as results of the oblique incidence and randomizing effects of the shock wave. Estimates of the required numbers of Platt particles show that the mass loss for even a very old comet is negligible. (auth)

917 THREE-BODY CAPTURE OF INTERSTELLAR DUST BY THE SOLAR SYSTEM. Bandermann, L. W.; Wolstencroft, R. D. (Univ. of Hawaii, Honolulu). Mon. Notic. Roy. Astron. Soc.; 150: 173-86(1970).

The rate of three-body capture of interstellar dust by the solar system is less than 2×10^4 g s^{-1} assuming the density of interstellar dust is 3×10^{-26} g cm^{-3} and the typical heliocentric velocity of the dust is 20 km s^{-1}. This rate is two orders of magnitude smaller than that calculated by Radzievskii and the rate of loss from the zodiacal cloud determined from the Poynting–Robertson effect by Whipple. Therefore one cannot substantiate Radzievskii's conclusion that interstellar dust can maintain the zodiacal dust cloud. (auth) (UK)

918 ULTRAVIOLET LINE PROFILES OF O I IN THE SOLAR SPECTRUM. Bruner, E. C. Jr.; Jones, R. A.; Rense, W. A.; Thomas, G. E. (Univ. of Colorado, Boulder). Astrophys. J.; 162: 281-5(Oct 1970).

High-resolution profiles of the lines of the solar oxygen triplet at 1302 to 1306 Å are presented and discussed. The profiles were obtained from spectrograms photographed at various average altitudes during two separate flights of Aerobee rockets. Allowance for the effects on the profiles by absorption due to atomic oxygen in the Earth's atmosphere was made for two models of the Earth's atmosphere. Calculations from the model atmosphere of intermediate density of telluric atomic oxygen led to profiles for the triplet lines which are flat-topped or, at best, slightly reversed. (auth)

919 OBSERVATION OF SOLAR X-RAYS WITH A SOLID-STATE DETECTOR. Turiel, Isaac; MacGregor, G. Allen (Univ. of California, Livermore). Astrophys. J.; 162: 287-91(Oct 1970).

The spectrum of a class 1b solar flare is presented between 4 and 16 keV. It appears that this continuum spectrum can best be described by thermal-bremsstrahlung emission from an isothermal gas. The spectrum was obtained from a sounding-rocket experiment incorporating a liquid-nitrogen-cooled solid-state detector having an area of 2 cm^2. The full width at half-maximum was 680 eV at an energy of 6 keV and 820 eV at an energy of 27.5 keV. The emission measure was observed to increase during the decay of the flare. (auth)

920 TEMPERATURE AND EMISSION-MEASURE PROFILES OF TWO SOLAR X-RAY FLARES. Kahler, S. W. (Naval Research Lab., Washington, D. C.); Meekins, J. F.; Kreplin, R. W.; Bowyer, C. S. Astrophys. J.; 162: 293-304(Oct 1970).

Data from the NRL 2- to 20-keV x ray detector on the OGO-5 satellite are discussed. A detailed study of two solar x-ray flares shows that the 3- to 12-keV flux is thermal in origin, with emission measures which vary by 2 orders of magnitude during the course of the flares analyzed. A physical interpretation of the energy dispersion of the times of peak x-ray fluxes is given. Heating of a flare region by nonthermal electrons is proposed for the flare of June 9, 1968. (auth)

921 Kα SATELLITE-TYPE LINES IN IRON. Veigele, William J. (Kaman Nuclear, Colorado Springs, Colo.). Astrophys. J.; 162: 357-60(Oct 1970).

Wavelengths for satellite-type lines resulting from $2p \rightarrow 1s$ electron transitions in iron with vacancies in both the 1s and 2s electron shells were calculated, by means of a screening-constant method, for iron in all states of ionization of the outer electron shells. The line for Fe XV differs by 0.6% from the value determined by means of the Hartree–Fock wave functions. (auth)

922 NONCOLLISIONAL COUPLING BETWEEN THE ELECTRON AND THE PROTON COMPONENTS IN THE TWO-FLUID MODEL OF THE SOLAR WIND. Cuperman, S.; Harten, A. (Tel Aviv Univ., Israel). Astrophys. J.; 162: 315-26 (Oct 1970).

A two-fluid model of the solar wind with appropriate boundary conditions is used to describe the average behavior of electrons and protons in the expanding solar corona. Rotation, viscosity, and magnetic fields are neglected. Ordinary "collisional" coupling between the two species gives particle density, bulk velocity, and electron temperature close to the observed average values at about 1 A.U. However, the proton temperature is too low, providing a temperature ratio of 1 A.U. of $T_e/T_p \simeq 17$ (instead of the observed value of about 4). Consideration of a "noncollisional" coupling about 30 times larger than the collisional one provides the proper proton temperature in addition to the other parameters. Thus, since no external nonthermal heating source beyond the "critical" distance is required, unstable wave–particle interactions are clearly indicated to be responsible for the observed fluid-like behavior of the solar wind. Increased coupling (artificially high) brings the two-fluid solutions, as required, close to those given by one-fluid equations. (auth)

923 EXTENSION OF THE THEORY OF LINE BROADENING BY NEUTRAL ATOMS TO HIGHER-ORDER TERMS IN THE INTERACTION POTENTIAL. Fullerton, Wayne; Cowley, Charles (Univ. of Michigan, Ann Arbor). Astrophys. J.; 162: 327-32 (Oct 1970).

The usual theory of van der Waals broadening uses the first term in an expansion for the perturbation of the radiating atom by a neutral perturber. A straightforward extension of this theory was made by retaining higher-order terms in the expansion. The conventional approximations were employed. The theoretical damping constant is increased by a factor which is usually less than 2. (auth)

924 BRIGHTNESS TEMPERATURES OF THE QUIET SUN AND THE NEW MOON AT 3.3- AND 5.7-mm WAVELENGTHS. Reber, E. E. (Aerospace Corp., El Segundo, Calif.). Icarus; 12: 348-59(May 1970).

Absolute brightness temperatures and brightness temperature ratios of the quiet Sun and the center of the new Moon were measured at the 3.3-mm wavelength and at several wavelengths in the 5.7-mm region. Radiometric maps of the Sun and new Moon are used to illustrate the problems associated with brightness temperature measurements of these sources. Measured quiet Sun/new Moon brightness temperature ratios and reported central brightness temperatures of the new Moon in the millimeter wavelength region confirm the measured absolute brightness temperatures of the quiet Sun. Reported solar brightness temperatures in the 5.7- to 1.0-mm wavelength interval are tabulated and presented graphically as a function of frequency and wavelength. The regression-line equation computed for the reported measurements is given for estimating solar brightness temperatures at any wavelength in this interval and is solved for the wavelengths of the reported measurements. (auth)

925 SOLAR AND METEORITIC ABUNDANCES OF MERCURY. Grevesse, N. (Univ., Liege). Geochim. Cosmochim. Acta; 34: 1129-30(Oct 1970).

It is shown, from the absence of Hg I lines in the solar photo-

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spheric spectrum, that the solar mercury abundance must be lower than the value found in carbonaceous chondrites. (auth) (UK)

Galaxies

926 SURVEY OF GALACTIC NEUTRAL HYDROGEN. Venugopal, V. R.; Shuter, W. L. H. (Univ. of British Columbia, Vancouver). Mem. Roy. Astron. Soc.; 74: 1-65(1970).

A catalogue of 1047 profiles of 21-cm line emission covering the entire Galaxy north of declination −29° is presented. Data were obtained using the 25.6-m paraboloid at the Dominion Radio Astrophysical Observatory, Penticton, which has a half-power beamwidth at λ = 21 cm of 36′, and a 100 channel H-line receiver with filter bandwidths of 10 KHz. Profiles were taken in a grid with points spaced 5° apart with positions specified in new galactic coordinates. Intensities are specified in units of brightness temperature and radial velocities are referred to the local standard of rest. (auth) (UK)

927 APEX OF SOLAR MOTION OF NEUTRAL HYDROGEN CONCENTRATIONS AT DIFFERENT VELOCITIES. Venugopal, V. R. (Dominion Radio Astrophysical Observatory, Penticton, Can.). Nature (London); 228: 44-5(3 Oct 1970).

Reference is made to Dieter (Pub. Astrom. Soc. Pacific, 81: 186 (1969)), who used data from a Berkeley neutral H survey to show that in almost every case high-velocity condensations occur where there is evidence of excess gas at more moderate velocities and found evidence for physical interaction between gas masses at different velocities at the same location in the sky. The present author investigated whether Dieter's data also showed a kinematic relationship. It was found that the apex of solar motion of gas with velocities >70 km/sec is not very different from that of gas with velocities <70 km/sec. The apexes are in the galactic plane, which suggests that the gas concentrations are related to the Galaxy. The close agreement between the directions of solar motion of groups with velocities >70 and <70 km/sec suggests that the group may have a common dynamic origin which, perhaps, is a supernova explosion. (UK)

928 NONRELATIVISTIC EQUATIONS OF BULK MOTION OF A RELATIVISTIC GAS. III. DAMPING OF THE SUPRATHERMAL MODE BY RANDOM FLUCTUATIONS. Lerche, I. (Univ. of Chicago). Contract F-19628-69-C-0041. Astrophys. J.; 162: 161-8(Oct 1970).

It is shown that spatially random fluctuations in the cosmic-ray pressure damp the suprathermal hydromagnetic mode propagating perpendicularly to the ambient interstellar magnetic field. Since all the hydromagnetic modes of the interstellar gas are Landau (or collision) damped (except the suprathermal mode propagating perpendicularly and the Alfvén mode propagating exactly parallel) in about ten wavelengths, and since random fluctuations damp the suprathermal mode (also in about ten wavelengths), it now appears that all low-frequency signals in the interstellar medium are "localized" to within about ten wavelengths of their source, with the possible exception of the parallel-propagating Alfvén mode. And by this is meant that beyond about ten wavelengths from its source such a low-frequency signal does not preserve any knowledge of its origin, and can itself be regarded as locally produced random noise. (auth)

929 NUCLEOCHRONOLOGIES AND THE MEAN AGE OF THE ELEMENTS. Schramm, David N.; Wasserburg, G. J. (California Inst. of Tech., Pasadena). Astrophys. J.; 162: 57-69(Oct 1970).

The equations for a nucleosynthetic chronology are shown to be separable with the equations for extremely long-lived and stable nuclei yielding the mean age of the elements. This result is independent of the time-dependent production model used. This mean age is a lower bound on the age of the elements. The age of the elements is critically model-dependent. The short-lived isotopes are shown to yield the formation interval for the solar system which also is essentially model-independent. The short-lived and intermediate-lived isotopes taken relative to stable isotopes are shown to yield information on the rate of r-process nucleosynthesis with time and thus may provide the distribution of supernovae in time within the Galaxy. (auth)

930 DISK LIKE RIEMANN ELLIPSOIDS. Hunter, C. (Massachusetts Inst. of Tech., Cambridge). Astrophys. J.; 162: 97-103(Oct 1970).

Elliptical disks with internal motions are possible equilibria of gravitating gas with negligible pressure, and may be useful models of galaxies at an early stage of development. These disks are stable to the largest-scale modes of oscillation when eccentric, and when the ratio of total angular momentum to total circulation, or its inverse, exceeds certain critical values. (auth)

931 CONVERSION FROM MEASURED LINE-OF-SIGHT TO SPACE-VELOCITY DISPERSION FOR A SPHERICAL CLUSTER OF GALAXIES: APPLICATION TO THE MASS–LUMINOSITY RATIO OF THE COMA CLUSTER. Rood, Herbert J. (Wesleyan Univ., Middletown, Conn.). Astrophys. J.; 162: 333-6(Oct 1970).

Abell's and Oort's determinations of the ratio of dynamical mass to luminosity of the Coma cluster are reviewed and refined. The revised estimate is $M/L_v = 270 \pm 60\ M_\odot/L_{v\odot}$ (for H = 75 km sec^{-1} Mpc^{-1}). (auth)

932 FAR-ULTRAVIOLET PHOTOGRAPHY OF ORION: INTERSTELLAR DUST. Henry, Richard C. (Hulburt Center for Space Research, Washington, D. C. Johns Hopkins Univ., Baltimore); Carruthers, George R. Science; 170: 527-31(30 Oct 1970).

Wide-angle photography of Barnard's Loop Nebula suggests that the nebular emission is much less intense in the 1230- to 2100-Å spectral region than in the 2200- to 3200-Å near-ultraviolet region. This contrast may be due to differences in the absorption or scattering properties of the interstellar grains in these two wavelength regions. (auth)

933 MOLECULES IN THE INTERSTELLAR MEDIUM. I. Snyder, Lewis E. (Univ. of Virginia, Charlottesville); Buhl, David. Sky Telesc.; 40: 267-70(Nov 1970).

The history of the detection of molecules in interstellar space is reviewed in terms of diatomic and polyatomic molecules. Recent discoveries are discussed in some detail. (W.D.M.)

Cosmology

934 QUARKS AND ASTRONOMY. Nichitiu, Florian. Stud. Cercet. Astron.; 15: No. 1, 105-11(1970). (In Rumanian).

The properties of quarks and the actual methods for finding quarks especially the astronomical methods under the assumption of quark atoms and quark ions are discussed in a qualitative way. The problem of quarks participating in quasar dynamics is considered. Two new reaction models with Coulomb potential barrier (hence inexplosive reactions) are reported—which may account for considerable energy due to the participating protonic quarks (one assumes m_q = 10 GeV). (auth)

935 SYNCHROTRON HYPOTHESIS OF ORIGIN OF BACKGROUND RADIATIONS. Prilutskii, O. F.; Rozental, I. L. (Moscow Engineering-Physics Inst.). JETP Lett. (USSR) (Engl. Transl.); 12: 131-3(20 Aug 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 189-91(20 Aug 1970).

The question of the sources of the background radiation is considered in the framework of the synchrotron hypothesis. The break in the x-ray spectra at 10 to 100 keV is discussed. (W.D.M.)

936 PHILOSOPHY FOR BIG-BANG COSMOLOGY. McCrea, W. H. (Univ. of Sussex, Eng.). Nature (London); 228: 21-4(3 Oct 1970).

It is argued that, according to recent developments in cosmology, a model Universe like the observed Universe is bound to be formed almost independently of how it started. Such ideas, if valid, provide fresh justification for the procedures of current cosmological theory. (auth) (UK)

937 SPHERICALLY SYMMETRIC, CHARGED BODY IN RAINICH'S ALREADY UNIFIED FIELD THEORY. Klotz, A. H.; Lynch, J. (Univ. of Sydney). Mon. Notic. Roy. Astron. Soc.; 150: 149-54(1970).

A model of an electrically charged object is derived from the equations of Rainich's Already Unified Field Theory. The object is represented as a charged conducting sphere surrounded by a concentric shell of dielectric matter. It is shown that if such bodies exist they should be appreciably smaller than the corresponding, electrically neutral Schwarzschild stars. (auth) (UK)

938 HOYLE–NARLIKAR THEORY OF GRAVITATION. Davies, P. C. W. (Univ. of Cambridge, Eng.). Nature (London); 228: 270-1(17 Oct 1970).

The Bohr quantization of the Hoyle–Narlikar theory of gravitation (Proc. Roy. Soc., 282: 191(1964)) is discussed; this theory derives from a direct interparticle action. The theory is Machian in the sense that the equations of motion do not exist in the limit of a one-particle Universe. (UK)

939 GENERAL-RELATIVISTIC LIGHT DEFLECTION FOR THE COMPLETE CELESTIAL SPHERE. Ward, William R. (California Inst. of Tech., Pasadena). Astrophys. J.; 162: 345-7 (Oct 1970).

It is shown that the usual formula, $4GM/c^2l$, used to describe

the angular deflection of photons grazing the Sun with impact parameter l, can be applied to sources over the entire celestial sphere if it is multiplied by the correction factor $\frac{1}{2}(1 + \cos\theta)$, where θ is the angle between the center of the deflecting mass and the object observed. (auth)

940 CLASS OF HOMOGENEOUS COSMOLOGICAL MODELS. II. OBSERVATIONS. MacCallum, M. A. H.; Ellis, G. F. R. (Dept. of Applied Mathematics and Theoretical Physics, Cambridge, Eng.). Commun. Math. Phys.; 19: 31-64(1970).

The application of geometric optics to the study of observational properties of cosmological models examined in a previous paper is discussed. A number of results concerning these properties are derived, the most interesting of which is the invariance of observational relations under certain discrete isotropy groups. Closed-form expressions are obtained in certain cases. (auth)

941 TRANSFORMATION TO ROTATING COORDINATES. Atwater, H. A. (Pennsylvania State Univ., University Park). Nature (London); 228: 272-3(17 Oct 1970).

It is stated that in the treatment of problems involving rotating coordinate frames two viewpoints may be adopted. It may be assumed either that the use of principles familiar in special relativity can be extended to the rotating coordinate case, or that a general relativistic treatment may be employed, with use of an explicit coordinate transformation for uniform rotation in proceeding from the inertial frame to the rotating frame. The first approach leads to a "paradox," illustrated by the rotating disk model, in that distances in the radial direction are assumed to be unaffected by the rotary motion, since these are everywhere orthogonal to the direction of motion. The fallacy in this approach is pointed out, and it is stated that the special-relativistic assumption must be discarded. Derivation of the equations of the electromagnetic field in a rotating reference frame is also discarded. It is also pointed out that measurements of the anisotropy of the velocity of light are capable in principle of verifying the correctness of the coordinate transformation to rotating coordinates, but until the results of such measurements are available it must be recognized that there is not a verified form for the law of transformation to rotating coordinates. (UK)

942 COMMENTS ON THE BIG-BANG. Harrison, E. R. (Univ. of Cambridge, Eng.). Nature (London); 228: 258-60 (17 Oct 1970).

A discussion is presented as to whether the big bang was hot, warm, or cold; and also whether galactic masses are determined by the interplay of gravitational and strong interactions in the very early Universe. (auth) (UK)

943 CRITICAL PARAMETERS FOR SUPERMASSIVE OBJECTS IN GENERAL RELATIVITY. Kovetz, A. (Tel Aviv Univ., Israel); Shaviv, G. Astrophys. Space Sci.; 8: 256-61 (Aug 1970).

Evolutionary tracks up to the point of dynamical instability were obtained for isentropic objects with rest masses ranging from 10^2 $M_\odot$ to 10^7 $M_\odot$. Accurate values for the redshift, specific entropy, luminosity, and effective temperature at the onset of collapse are given. (auth)

Planetary Phenomena

944 ISOTOPE ANALYSIS OF MOON SAMPLES. Kirsten, T. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Naturweissenschaften; 57: 236-9(May 1970). (In German).

Experimental results obtained on moon samples supplied by Apollo 11 are summarized. Dating is discussed according to the U/Th–Pb system, for the Rb–Sr system, and the K–Ar system. In addition, effects on the lunar surface are discussed for both soil shifting and solar wind. (H.B.G.)

945 BEAMING OF ELECTROMAGNETIC RADIATION BY PLANETARY IONOSPHERES. Kerdemelidis, Vassilios (Univ. of Canterbury, Christchurch, N. Z.). Icarus; 12: 431-4(May 1970).

Use is made of elementary analytical and experimental results to predict an increased directivity from sources radiating inside or outside plasma layers. It is found that the directivity enhancement is higher when the source is between two plasma layers. Since a single layer employed as a reflector gives only a moderate directivity, a double-peaked ionosphere with sources between the two "layers" is postulated to explain the large bursts from planets, such as the decametric radiation from Jupiter. For greater directivity, at a given signal frequency, the outside layer of the ionosphere must be near resonance and the inside layer overdense. If the layer near the plasma frequency is viewed as a partially reflecting screen then the maximum power gain for a source between the two layers may be written, approximately, $G = A(1 + p)/(1 - p) \to \infty$ as $p \to 1$, where p is the magnitude of the reflection coefficient of the outside layer and A a constant. For the inside layer $p = 1$. This analysis predicts radio bursts from other suitable planets or extrasolar bodies and an enhanced radar return from the night E layers on Earth. If now the two postulated spherical layers are nonconcentric a longitude dependence of layer separations and, consequently, of resonant frequencies will appear (this assumes constant electron density). Thus the planetary rotation, on this model, gives rise to dynamic spectra of the observed form, i.e., in the "early" sources the drift is from low to high frequencies, for "late" sources the reverse is true. In the idealized twin plasma layer model considered neither the plasma losses due to collisions nor the anisotropy of the medium are taken into account. (auth)

946 APOLLO 12 LUNAR SAMPLES: TRACE ELEMENT ANALYSIS OF A CORE AND THE UNIFORMITY OF REGOLITH. Ganapathy, R.; Keays, Reid R.; Anders, Edward (Univ. of Chicago). Contracts NAS 9-7887; AT(11-1)-382. Science; 170: 533-5(30 Oct 1970).

Four core and soil samples from Apollo 12 are enriched in a number of trace elements of meteoritic origin to virtually the same degree as Apollo 11 soil. An average meteoritic influx rate of about 4×10^{-9} g/cm^2/yr thus seems to be valid for the entire Moon. A sample from a light gray, coarse-grained layer in the core resembles lunar basalts in composition, but is enriched by factors of 10^4 to 10^5 in bismuth and cadmium. (auth)

947 X-RAY GLOW FROM PLANETARY ATMOSPHERES. Aikin, A. C. (Goddard Space Flight Center, Greenbelt, Md.). Nature (London); 227: 1334(26 Sep 1970).

The results of calculations of the x-ray fluorescence spectrum which should be observable from a spacecraft near a planet are given, and it is stated that this spectrum should be a valuable tool in the determination of the composition of planetary atmospheres, particularly with regard to minor constituents such as Ne and Ar on Venus and Mars and N_2 and C on Jupiter; it might also be used to detect and identify the atmosphere of Mercury. The characteristic Kα emissions of elements which make up planetary atmospheres are listed, together with the probability of K fluorescence. The results of calculations at 4,000 km for different elements where the subsatellite point is the same as the subsolar point are also given. The results are limited, however, by the great uncertainties in the atmospheric models. The cases of Mercury, Venus, Mars, and Jupiter are considered. It was recognized that periods of solar activity could increase the fluorescence emission, particularly below 30 Å, and the precipitation of energetic particles would contribute to the fluorescence for the Earth's auroral zone. Attempts to detect Hα emission from Jupiter have, however, so far yielded negative results. In most cases the atmospheric constituents should be detectable by instrumented spacecraft within 10^4 km of the planet. The flux expected at Earth orbit should be on the average, 10^{-8} of that appearing at 4×10^3 km, from the planet, which is probably less than the x-ray background. (UK)

948 GLASSY PARTICLES IN LUNAR FINES. Mueller, George; Hinsch, Gertrude W. (Univ. of Miami, Coral Gables, Fla.). Nature (London); 228: 254-8(17 Oct 1970).

It was found that most of the Apollo II glassy particles differ from those generated by terrestrial volcanism, by meteoritic impacts, or by the condensation of the parent bodies of meteorites. Some of the particles may have been formed by the action of solar flares on the lunar surface. (auth) (UK)

949 CHARGED PARTICLE TRACK STUDIES IN LUNAR ROCK 12013. Burnett, D. S.; Monnin, M.; Seitz, M.; Walker, R.; Woolum, D.; Yuhas, D. (Washington Univ., St. Louis). Earth Planet. Sci. Lett.; 9: 127-36(Sep 1970).

Etched samples from an interior chip of rock 12013 shows fossil nuclear-particle tracks in Ca feldspar, K feldspar, and pyroxene. These fossil tracks are attributed predominantly to galactic cosmic rays. The track density in the pyroxene is much lower than in the feldspars, suggesting that tracks have been partially recovered by thermal annealing or mechanical shock. If it is assumed that no recovery has occurred in the feldspars, the data give an exposure age of $15 \pm 3 \times 10^6$ yr on the surface of the Moon. The interior chip also contains grains of a phosphate mineral that exhibits an inhomogeneous distribution of etch pits of the kind normally produced by tracks. The density of these pits is higher than the background density of cosmic-ray tracks and could be produced by the spontaneous fission of uranium. Maps of the uranium distribution show strong local concentrations that are frequently, if not always, associated with phosphates. The U concentration in one grain leads to a fission-track age of $\lesssim 1.4 \times$

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10^9 yr, again suggesting partial recovery. No evidence for excess fission tracks from the decay of ^{244}Pu is found. The track density rises sharply towards the surface showing the effects of low-energy solar particles. By studying the track densities in the vicinity of an impact pit, it is concluded that the pit was formed relatively recently in the history of the rock ($\lesssim 3 \times 10^6$ yr ago). (auth)

950 MINERALOGIC AND ISOTOPIC INVESTIGATIONS ON LUNAR ROCK 12013. Albee, A. L.; Burnett, D. S.; Chodos, A. A.; (and others) (California Inst. of Tech., Pasadena). Earth Planet. Sci. Lett.; 9: 137-63(Sep 1970).

The petrology and mineralogy of lunar rock 12013 is presented in detail. Xenon isotopes, neutron dosage, uranium distribution, and Rb–Sr study are other topics covered extensively. (W.D.M.)

951 LUNAR ROCK 12013; O, Si, Al, AND Fe ABUNDANCES. Morgan, J. W.; Ehmann, W. D. (Univ. of Kentucky, Lexington). Earth Planet. Sci. Lett.; 9: 164-8(Sep 1970).

The abundances of O, Si, Al, and Fe were determined by 14-MeV neutron activation analysis in 5 chips and 3 powders derived from Apollo 12 lunar rock 12013. These four elements constitute approximately 90% of the mass of this rock. Mass-weighted mean abundances in weight percent for the five chips where contamination problems are expected to be minimal are: O: 45.2%, Si: 28.4%, Al: 6.5%, and Fe: 10%. A significant positive correlation was observed for Si and O abundances in the chips and a linear regression line drawn through these data passes close to the mean for the Apollo 11 breccias. A significant negative correlation was observed for Al with Si in the chips (auth)

952 ELEMENTAL ABUNDANCES IN SEVEN FRAGMENTS FROM LUNAR ROCK 12013. Wakita, H.; Schmitt, R. A. (Oregon State Univ., Corvallis). Earth Planet. Sci. Lett.; 9: 169-76 (Sep 1970).

Abundances of the major (Ti, Al, Fe, Ca, Na, and K), minor (Cr, Mn, and Ba), and trace (Sc, V, Co, Hf, La, Sm, Eu, Yb, Lu, Th, and U) elements were obtained via INAA (instrumental neutron activation analysis) in seven fragments (32 to 98 mg each) chipped from a slab of Apollo-12 rock 12013. These same fragments were previously analyzed for Si and O and subsequent to INAA were subjected to radiochemical neutron activation analysis by Laul et al. (1970). With a few exceptions, average abundances agree with those obtained earlier. High abundances of K, Ba, Th, and U are confirmed. A heterogeneous composition is indicated by large elemental abundance dispersions. K and Ba vary linearly over a sixfold K and threefold Ba abundance pattern; Th and U, as well as K and Ba, vary sympathetically with Si content. Rare earth element (REE) abundances are similar in five fragments and different in two others. Relative to chondrites, Eu is severely and variably depleted in all fragments. In six fragments, the chondritic normalized REE distributions (Eu excluded) are concave, upward and in the remaining fragment, the distribution (Eu excluded) resembles those observed in Apollo 12 soil. Average REE abundances and Sm/Eu ratio in 12013 suggest this rock is more closely related to Apollo 12 soil than Apollo 12 crystalline rocks. Interelement correlations suggest 12013 is composed of two principal fractions: an alkali–barium feldspar and a fraction consisting of minerals that are related to the composition of Apollo 12 soil. (auth)

953 ^{40}Ar–^{39}Ar AGE DETERMINATION OF LUNAR ROCK 12013. Turner, Grenville (Univ. of Sheffield, Eng.). Earth Planet. Sci. Lett.; 9: 177-80(Sep 1970).

Two samples of lunar rock 12013 (12013, 10-26, white fragment with high K and 12013, 10-43, dark inclusion with low K) were analyzed by the ^{40}Ar–^{39}Ar technique. ^{40}Ar/^{39}Ar ratios measured in a stepwise heating experiment on both samples were essentially constant and equal throughout, indicating a uniform ^{40}Ar/K ratio in both samples. There is no evidence of any appreciable amount of ^{40}Ar loss, neither is there any evidence of excess argon in the two small samples analyzed. The ^{40}Ar/^{39}Ar ratio, in both samples, when compared with that in a terrestrial monitor irradiated alongside, corresponds to a K–Ar age of $(3.87 \pm 0.07) \times 10^9$ yr. (auth)

954 RARE EARTH, ALKALINE, AND ALKALI METAL AND ^{87} ^{86}Sr DATA FOR SUBSAMPLES OF LUNAR SAMPLE 12013. Hubbard, Norman J (Manned Spacecraft Center, Houston, Tex.); Gast, Paul W.; Wiesmann, Henry. Earth Planet. Sci. Lett.; 9: 181-4(Sep 1970).

Four subsamples of lunar rock 12013 were analyzed. A "whole rock" sample has high rare earth and very high Ba concentrations with the chondrite normalized abundance pattern showing a slight enrichment in Ba and Ce and the usual large negative Eu anomaly. The light and dark components of this rock have similar REE. The light colored materials are commonly quite enriched in radiogenic ^{87}Sr and the Rb–Sr system appears to have lost Rb. (auth)

955 Li, K, Rb, Sr, Ba, AND RARE-EARTH CONCENTRATIONS, AND Rb-Sr AGE OF LUNAR ROCK 12013. Schnetzler, C. C. (Goddard Space Flight Center, Greenbelt, Md.); Philpotts, J. A.; Bottino, M. L. Earth Planet. Sci. Lett.; 9: 185-92(Sep 1970).

The light and dark-colored portions of 12013 are characterized by two distinct trace element patterns. The light-colored portions are lower in rare earths, slightly lower in Sr, the same in Li and in K, Rb, and Ba when compared to the dark-colored portions. The dark material appears to represent a late liquid in the normal igneous differentiation scheme suggested by the other lunar rocks; the light-colored material may have had a more complex history. Comparisons of trace element abundances of Apollo 12 igneous rocks and soil suggest that the dark material of 12013 may constitute an important component of the soil. The best-fit isochron to nine data points yields an Rb–Sr age of $4.1 \pm 0.2 \times 10^9$ yr with an initial ratio of 0.704 ± 0.002. (auth)

956 U–Th–Pb AGE OF APOLLO 12 ROCK 12013. Tatsumoto, Mitsunobu (Geological Survey, Denver). Earth Planet. Sci. Lett.; 9: 193-200(Sep 1970).

A U–Th–Pb isotopic study of three chips from lunar rock 12013 indicates that parental material of the intrusion breccia formed quite early in the Moon's history, possibly 3.9 to 4.3×10^9 yr ago. The U–Th–Pb characteristics of the rock are distinctly different from those of other Apollo 12 igneous rocks and suggest a different origin. (auth)

957 RARE GASES FROM STEPWISE HEATING OF LUNAR ROCK 12013. Alexander, E. C. Jr. (Univ. of California, Berkeley). Earth Planet. Sci. Lett.; 9: 201-7(Sep 1970).

Helium, neon, argon, and xenon data are presented from a seven step heating of lunar rock 12013. Helium, neon, and argon contain radiogenic and spallation components with no discernible trapped component. ^{3}He and ^{21}Ne cosmic-ray exposure ages are $60 \pm 12 \times 10^6$ yr. The xenon contains a well defined spallation component, a fission component, and possibly a trapped component but no evidence for decay products of extinct ^{129}I or ^{244}Pu. Apparent solidification ages are UTh–He: $2.3 \pm 0.5 \times 10^9$ yr; K–Ar: $3.0 \pm 0.7 \times 10^9$ yr; ^{238}U–^{136}Xe: $3.6^{+1.4}_{-1.4} \times 10^9$ yr (assuming solar-wind type xenon as trapped xenon) or $2.2^{+1.4}_{-1.2} \times 10^9$ yr (assuming atmospheric trapped xenon). (auth)

958 OXYGEN AND SILICON ISOTOPE RATIOS OF LUNAR ROCK 12013. Taylor, Hugh P. Jr.; Epstein, Samuel (California Inst. of Tech., Pasadena). Earth Planet. Sci. Lett.; 9: 208-10 (Sep 1970).

The δ ^{18}O and δ ^{30}Si values of six whole-rock samples from the high-SiO_2 lunar rock 12013, 10 are very uniform at +5.95 to +6.34 and –0.49 to –0.07, respectively. These data are very similar to those obtained on terrestrial basalts and gabbros, the previously analyzed Apollo 11 lunar rocks, and terrestrial rhyolite obsidians from oceanic areas. Rock 12013 is, however, distinctly lower in ^{18}O than tektites and terrestrial plutonic granitic rocks, strongly suggesting that tektites do not come from the Moon. (auth)

959 ABUNDANCE OF 14 TRACE ELEMENTS IN LUNAR ROCK 12013, 10. Laul, J. C.; Keays, R. R.; Ganapathy, R.; Anders, E. (Univ. of Chicago). Earth Planet. Sci. Lett.; 9: 211-15(Sep 1970).

Seven samples of lunar rock 12013, 10 were analyzed by neutron activation analysis for Ag, Au, Bi, Br, Cd, Co, Cs, Ga, In, Ir, Rb, Se, Tl, and Zn. Traces of the meteorite which produced the breccia seem to be present in 3 samples; the amount can be expressed as $\leq$1.0%, $\leq$0.19%, and $\leq$0.16% Cl chondrite equivalent, but the composition seems to have been less primitive than Cl. Rb, Cs, Tl, and Cd vary 5- to 20-fold among samples. These elements correlate with each other and with K. The interelement ratios are nearly constant, and fit the trend for other Apollo 11 and 12 crystalline rocks. Au and Br both correlate with Zn, with a slope greater than 1. One is inclined to infer a local rather than highland origin for rock 12013, 10 from these correlations. From Tl/K and K/U ratios, it appears that Tl is depleted on the lunar surface by a factor $\approx 7 \times 10^{-3}$ relative to the Earth's crust. Judging from the mean Rb, Cs, and U abundances, about 12% of material-like rock 12013, 10 would have to be added to Apollo 12 basalts to account for the high Rb, Cs, U content of the 12070 soil. (auth)

Atomic and Molecular Physics

Atomic, Electron, Ion, and Molecular Beams and Their Reactions

Refer also to abstracts 1455 and 1681.

960 (AD-709258) CLASSICAL THEORY OF ELECTRON SLOWING DOWN-COMPARISON WITH EXPERIMENT. Sherman, Charles H.; Gordon, Nan E. (Parke Mathematical Labs., Inc., Carlisle, Mass.). May 1970. Contract F19628-68-C-0188. 45p. (AFCRL-70-324). NTIS.

Classical differential cross sections for scattering of a free electron by a bound electron are used to calculate the electron slowing-down spectrum for cases in which experimental results are available for comparison. The calculations are found to be in good agreement with measurements in aluminum, copper, and gold from 300 eV to 20 keV when a single, average, empirically determined binding energy is used. The agreement is not as good when the electronic structure of these metals is included in a more realistic way. Two different approximations to the classical cross section are used, and the one that presumably accounts more completely for the electron binding gives the poorer results. (auth) (USGRDR)

961 (KFK-1173) EMPIRICAL METHOD FOR CALCULATION OF THE ENERGY STRAGGLING IN THE SLOWING DOWN OF IONIZING PARTICLES. Schouky, I.; Seibt, E.; Weddigen, Ch. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik). Apr 1970. 16p. (In German). Dep. NTIS (U. S. Sales Only).

An empirical method is described to calculate the energy straggling for heavy ionizing particles. The application of this method involves an absorber-independent relative range straggling $2\Delta R/R$ (where R is the mean range) in addition to the usual differential energy loss and particle range. (auth)

962 SPUTTERING AND ELECTRON EMISSION UNDER MERCURY ION BOMBARDMENT IN THE ENERGY RANGE 15 TO 100 keV. Hepworth, J. K. (Marchwood Engineering Labs., Southampton, Eng.). J. Phys., D (London); 3: 1475-9(Oct 1970).

The sputtering ratios of stainless steel, tungsten, and molybdenum under mercury-ion bombardment were measured for ion energies between 15 and 100 keV. The measurements were made using a 100-keV ion source and the sputtering ratio was determined by the weight loss method using an electrostatic balance. The results are compared with available data where this is possible. (auth) (UK)

963 SIDEBAND DIFFRACTION: A PREDICTION OF THE QUANTUM FIELD THEORY OF INELASTIC LOW-ENERGY ELECTRON DIFFRACTION FROM SOLIDS. Duke, C. B.; Laramore, G. E.; Metze, V. (Univ. of Illinois, Urbana). Solid State Commun.; 8: 1189-93(1 Aug 1970).

A quantum field theory of inelastic electron diffraction is proposed and utilized to calculate the differential inelastic scattering cross section in fourth-order perturbation theory. The vestiges of momentum conservation normal to the surface cause the occurrence of a new phenomenon referred to as sideband diffraction. (auth) (UK)

964 CHARACTERISTIC ENERGY-LOSS SPECTRA FOR ELECTRONS IN Ru, Rh, AND Pd. Zashkvara, V. V.; Korsunskii, M. I.; Red'kin, V. S. (Inst. of Nuclear Physics, Alma-Ata, USSR). Sov. Phys.-Solid State (Engl. Transl.); 12: 993-4(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1270-1(Apr 1970).

Characteristic energy-loss spectra of a ~1-keV electron beam in pure Ru, Rh, and Pd were obtained for two scattering angles, 39 and 141°. The first two peaks are plasma-loss peaks; the position of the first peak is the same for both angles, while the second peak shifts to higher energies at 141°. The ratio E_2E_1 of the first two peaks is greater than the theoretical value of $\sqrt{2}$. The E_4 losses can be explained by ionization of the $N_{II,III}$ level. The E_5 losses at 55.4 and 60 eV in Ru and Rh can be attributed to double plasma excitation. (D.L.C.)

Atomic and Molecular Properties

Refer also to abstracts 921 and 1015.

965 (DESY-70/41) OPTICAL ABSORPTION OF CERIUM, CERIUM OXIDE, PRASEODYMIUM, PRASEODYMIUM OXIDE, NEODYMIUM, NEODYMIUM OXIDE AND SAMARIUM IN THE EXTREME. Haensel, R.; Rabe, P.; Sonntag, B. (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Aug 1970. 11p. Dep. NTIS (U. S. Sales Only).

The optical absorption of the rare earths Ce, Pr, Nd, and Sm was measured in the energy region 100 to 180 eV. The absorption spectra of the oxides of Ce, Pr, and Nd were determined in the same energy region. Synchrotron radiation of the 7.5-GeV electron synchrotron DESY was used as a light source. Transitions from the 4d level of the rare earths contribute the main part of the absorption in this energy region. At the onset of these transitions a number of sharp absorption maxima were found. This fine structure is followed by a broad absorption maximum, about 15 eV above the onset of 4d transitions, which is due to $d \rightarrow f$ continuum transitions. The absorption spectra of Ce and Ce oxide show a marked difference whereas the absorption spectra of Pr and Nd are very similar to those of their oxides. (auth)

966 (NSRDS-NBS-34) IONIZATION POTENTIALS AND IONIZATION LIMITS DERIVED FROM THE ANALYSES OF OPTICAL SPECTRA. Moore, Charlotte E. (National Bureau of Standards, Washington, D. C.). Sep 1970. 22p. GPO $0.75.

A current table of ionization potentials expressed in electron volts and a detailed table giving the limits from which they have been derived are presented. For each spectrum the ground term is given, with the limit as the ground state. The energy levels of terms of the lowest configuration, determined from ground state zero, are also included for selected spectra. The literature references used for each spectrum are indicated by number and listed in a bibliography with some 200 entries. The latest recommended conversion factor (cm^{-1} to eV) 0.000123981 corresponding to 1 eV = 8065.73 cm^{-1} has been used throughout. (auth)

967 L EMISSION SPECTRUM OF Eu. Gohkale, B. G.; Shukla, S. N. (Lucknow Univ., India). J. Phys., B (London); 3: 1175-9(Aug 1970).

A detailed study of the L emission spectrum of europium was made with the help of a focusing spectrograph of the transmission (Cauchois) type, having a mica crystal bent to a radius of curvature of 40 cm. A new diagram line at 1563.7 x.u. corresponding to the quadrupole transition $L_IN_{IV,V}$ (γ_{11}) in europium was observed for the first time. The presence of two more quadrupole lines corresponding to the $L_{II}N_{VI,VII}$ (γ_8') and the $L_{III}N_{VI,VII}$ (β_7') transitions was established. (auth) (UK)

968 ISOTOPIC EFFECT OF HYPERFINE BROADENING OF X-RAY LINES. Ryl'nikov, A. S.; Ivanov, G. A.; Marushenko, V. I.; Smirnov, A. I.; Sumbaev, O. I. (Ioffe Inst. of Physics and Tech., Moscow). JETP Lett. (USSR) (Engl. Transl.); 12: 88-90 (5 Aug 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 128-31(5 Aug 1970).

The isotopic hyperfine broadening of the x-ray $K\alpha_1$ ($1s_{\frac{1}{2}} - 2p_{\frac{3}{2}}$) line of ^{151}Eu compared with ^{153}Eu was measured. A Cauchois diffraction spectrometer was used to measure the $K\alpha_1$ lines from six Eu_2O_3 sources. The measured isotopic shift δ_{is} = 180 ± 10 MeV and hyperfine splitting Δ^{151} = 1.36 ± 0.12 eV are in good agreement with theoretical values. (D.L.C.)

969 NEW QUADRUPOLE TRANSITIONS IN THE L SPECTRUM OF GADOLINIUM. Nigam, A. N.; Kapoor, Q. S. (Univ. of Rajasthan, Jaipur, India). Indian J. Pure Appl. Phys.; 6: 644-5(Nov 1968).

The L spectrum of gadolinium was investigated with a 40-cm curved mica crystal spectrograph of the transmission type. Two new quadrupole lines at λ = 1502.1 and 1614.2 x.u. are reported for the first time and are assigned to the $L_IN_{I,IV,V}$(γ_{11}) and $L_{II}N_{III}$ transitions respectively. (auth)

970 OVERLAP MATRIX ELEMENTS AND RELATED INTEGRALS INVOLVING r_{12}^k TYPE CORRELATION FUNCTION FOR H_3^+ IN ONE-CENTER EXPANSION APPROXIMATION. Joshi, Bhairav D.; Anand, S. C. (Univ. of Delhi). Indian J. Pure Appl. Phys.; 6: 656-64(Dec 1968).

The wave function, Ψ, for equilateral triangular H_3^+ is expanded in terms of symmetry-adapted one-electron functions of the exponential type, and a correlation function of the r_{12}^k type is obtained. An expression is derived for the parent overlap integral, $\int \Psi^* \Psi d\tau$, in terms of simpler integrals. The simpler integrals are given in the closed form, and recurrence relations between them are also derived. The $C^{L_1}_{P,q,t}$ coefficients needed for evaluating the relevant integrals are calculated and tabulated. (auth)

971 DIFFERENTIAL OSCILLATOR STRENGTHS OF He AND C^{4+}. Stingl, E. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). J. Quant. Spectrosc. Radiative Transfer.; 10: 1237-40(Nov 1970).

Differential oscillator strengths for transitions from the metastable $(1s2s)2^1S$ states to the $(1s\varepsilon p)^1P$ continuum states of He and C^{4+} were calculated with the dipole-velocity formula. The continuum states were treated in the static-field approximation. Results are listed and are compared with those of Suh and Zaidi (Proc. Roy. Soc., 291: 94(1965)) for He. (auth) (UK)

972 NEW CONTINUOUS EMISSION SPECTRUM OF THE HYDROGEN MOLECULE. Dalgarno, A. (Harvard Coll. Observatory, Cambridge, Mass. Smithsonian Astrophysical Observatory,

Cambridge, Mass.); Herzberg, G.; Stephens, T. L. Astrophys. J.; 162: L49-53(Oct 1970).

The Lyman bands of hydrogen have been found to be accompanied by a continuous spectrum with pronounced fluctuations, different in H_2 and D_2. This continuum has been quantitatively accounted for by quantal calculations. It corresponds to the transitions from the various vibrational levels of the B $^1\Sigma_u^+$ state into the continuum of the X $^1\Sigma_g^+$ state; the fluctuations arise because of the effect of the nonterminal maxima of the continuum wave functions and represent the first clear-cut example of Condon's diffraction bands predicted in 1928. (auth)

973 SU (1,1) AS SOME KIND OF DYNAMICAL GROUP. Dymus, S. A. (Univ., Warsaw). Acta Phys. Pol.; A38: 309-20 (Sep 1970).

The problem of existence of a rotation-invariant representation of SU(1,1) generating the energy spectrum of a spinless particle subject to the action of central forces is investigated. Some assumptions based upon the 0(4,2) model of the nonrelativistic H-atom are made. Under these assumptions the construction of SU(1,1) representation is possible only for a very restricted class of potentials. Some of the representations obtained are used to find the energy spectrum of a relativistic, spinless particle in the attractive Coulomb potential. (auth)

974 He_3^+ AND He_4^+ IN 300°K HELIUM PLASMAS: THEIR EFFECT ON RECOMBINATION LOSS OF ELECTRONS. Gusinow, M. A.; Gerber, R. A.; Gerardo, J. B. (Sandia Labs., Albuquerque, N. Mex.). Phys. Rev. Lett.; 25: 1248-50(2 Nov 1970).

The existence of He_2^+ and He_4^+ at room temperature (300°K) in a helium afterglow was established. The data presented here indicate that the often-measured electron–ion recombination coefficient in 300°K helium afterglows is mainly attributable to electron recombination with He_2^+ rather than, as is usually assumed, with the dominant ion He_4^+. (auth)

975 NEW QUADRUPOLE AND FORBIDDEN LINES IN THE L EMISSION SPECTRUM OF CERIUM. Gokhale, B. G.; Shukla, S. N. (Lucknow Univ., India). J. Phys., B (London); 3: 1392-6(Oct 1970).

A 40-cm curved mica crystal spectrograph of the transmission (Cauchois) type was used to make a detailed study of the L emission spectrum of cerium. Four new diagram lines at 1899.7, 1921.2, 2008.0, and 2162.6 x.u., corresponding in that order, to the forbidden transition L_IO_I and the quadrupole transitions $L_IN_{IV,V}$, $L_{II}N_{VI,VII}$, and $L_{III}N_{VI,VII}$ were observed for the first time. The measurements of other dipole and quadrupole transitions were made with a view to comparing them with those of earlier workers. (auth) (UK)

976 GENERALIZED OSCILLATOR STRENGTHS FOR THE IONIZATION OF ATOMIC HELIUM. Bell, K. L.; Kingston, A. E. (Queen's Univ., Belfast). J. Phys., B (London); 3: 1300-7(Oct 1970).

The first Born approximation is used to calculate generalized oscillator strengths for the single ionization of atomic helium. Wave functions described by Bell and Kingston are employed to calculate both the length and velocity formulations of the Born matrix elements. Reasonable agreement is obtained with the available experimental data in the nonresonant energy-loss region. Comparison of theory and experiment near the first $^1P^0$ resonance in helium indicates that it may be possible to derive the resonance parameters using only first Born calculations together with accurate experimental data for three energy-loss values at any angle of scattering. (auth) (UK)

977 LINE STRENGTHS FOR TRANSITIONS BETWEEN DOUBLY EXCITED STATES AND THE 2^1S STATE OF HELIUM. Dickinson, H. O.; Rudge, M. R. H. (Queen's Univ., Belfast). J. Phys., B (London); 3: 1284-5(Oct 1970).

Calculations are presented for the line strengths of transitions connecting the doubly excited singlet series of levels with the 2^1S state of helium. The calculated expectation values $\langle E \rangle$ and $\langle r_1^2 \rangle$ for the doubly excited and the 2^1S states are also given. (auth) (UK)

978 STARK-EFFECT CALCULATIONS IN THE SECOND LYMAN SERIES OF IONIZED HELIUM. Korten, M.; Berg, H. F. (Physikalisches Institut, Aachen). Z. Phys.; 239: 322-30(1970).

The profiles of some lines of the second Lyman series of He II broadened by the microscopic Stark effect in plasmas of given temperatures and densities were calculated and compared to available experimental data. The comparison yielded reasonable agreement as to the resulting half-widths and lesser agreement in details of the line centers and wings. (auth)

Positronium, Muonium, and Mesic Atoms and Molecules

Refer also to abstracts 1397, 1419, and 1743.

979 ANALYSES OF K^- MESIC X-RAY YIELDS. Aslam, K.; Rook, J. R. (Nuclear Physics Lab., Oxford). Nucl. Phys.; B20: 397-404(1970).

An analysis is made of Wiegand's measurements of the K^- mesic X-ray yields from medium and heavy nuclei and Burhop's estimate of the difference between the proton and neutron densities in the surface region of nuclei. A model is used in which the proton and neutron densities are calculated from a potential well and the effect of nuclear deformation is included. Agreement is obtained with the X-ray yields within the experimental accuracy except for the case of ^{208}Pb. The model predicts about half of the proton-neutron density difference estimated by Burhop. (auth)

980 POSITRONIUM FORMATION IN INTERACTING ELECTRON GAS. Majumdar, C. K.; Rajagopal, A. K. (Tata Inst. of Fundamental Research, Bombay). Progr. Theor. Phys. (Kyoto); 44: 26-37(Jul 1970).

A two-body bound-state equation for a positron and an electron in an interacting electron gas is rederived, using a Green's function decoupling scheme, and various approximations required to define a bound state are explained. The equation has some new features not discussed before, and the solution rules out the formation of a positronium-like state at metallic densities. But the critical r_s value where the bound state formation starts is found to be higher than previously reported. (auth)

981 ROLE OF ELECTRON–ELECTRON INTERACTION IN THE THEORY OF POSITRON ANNIHILATION IN METALS. Rajagopal, A. K.; Majumdar, C. K. (Tata Inst. of Fundamental Research, Bombay). Progr. Theor. Phys. (Kyoto); 44: 13-25 (Jul 1970).

A system of interacting positrons, electrons, and phonons is studied to find out the role played by the electron–electron interaction in generating a dielectric function for the effective interaction felt by the positron. The motivation for this formulation is the absence of such a comprehensive theory in the literature. The form of the effective interaction for the lifetime calculation is slightly different from that to be used in the effective mass calculation, and the correct forms are derived. The Green's function method of Martin and Schwinger is used. A bound-state equation for electron–positron pairs is briefly discussed, and the implications of such an equation are pointed out: positronium formation is not possible in metals. (auth)

Collision Phenomena

Refer also to abstracts 131 and 1704.

982 (ITEF-764) FAST VARIATION OF HADRONIC AMPLITUDES AND GAMMA-QUANTA BREMSSTRAHLUNG. Ponomarev, A. A. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1970. 22p. (In Russian). Dep. NTIS (U. S. Sales Only).

Gamma-quanta bremsstrahlung is considered in hadronic reactions in the region of fast variation of hadronic amplitudes. The emission from the interaction region is found at the scattering near the resonance and at the high-energy diffraction scattering. The dependence of the radiation amplitude on the virtual properties of the hadronic amplitude is shown. Possible measurements of the off-shell mass effects in radiative scattering at high energies are discussed. (auth)

983 (N-70-32469) CROSS SECTIONS FOR IONIZATION IN COLLISIONS BETWEEN EXCITED NITROGEN MOLECULES AND CARBON MONOXIDE AND NITROGEN GROUND-STATE MOLECULES. Utterback, Nyle G.; Van Zyl, Bert (General Motors Corp., Santa Barbara, Calif. AC Electronics–Defense Research Labs.). Jun 1970. Contract NAS2-5680. 44p. (NASA-CR-73463; AC-DRL-TR-70-55). NTIS.

Research was initiated to validate a previously proposed model for bulk ionization. The model directly employs kinetic theory in terms of cross sections for ionization, and the reaction rate is determined by straightforward integration over all ionizing collisions. The important feature is that collisions between internally excited collision partners are not ignored, as they were previously. In validating the model, measurements were made for collisions between excited partners. The experimentation is described and the resulting cross section measurements are presented. (STAR)

984 (NP-18463) ELASTIC AND INELASTIC SCATTERING OF SLOW ELECTRONS BY ATOMS AND MOLECULES. Heide-

man, H. G. M. (Utrecht Rijksuniversiteit (Netherlands)). 1968. 151p. Dep. NTIS (U. S. Sales Only).

Measurements made during a study of electron–atom collisions included the following: (1) measurement of the polarization of several He and Hg spectral lines as a function of the energy of the exciting electron at electron energies ranging from the various excitation thresholds to about 10 eV above; (2) measurement of the relative zero-angle excitation curves of various He levels by electron scattering experiments; and (3) various measurements on elastic and inelastic electron scattering by diatomic molecules (H_2 and N_2) in the electron energy region from 0 to 40 eV. Results are compared with calculations based on the Bethe–Born theory, and a qualitative interpretation of some of the resonance phenomena observed is offered. (A.G.W.)

985 ELASTIC SCATTERING OF ELECTRONS BY HELIUM ATOMS AT LOW ENERGY. Roy, Amulya Chandra (Univ. of Kalyani, India). Indian J. Pure Appl. Phys.; 6: 461-4(1968).

The variational methods of Hulthen and Kohn have been applied to the elastic scattering of slow electrons by helium atoms, the effect of both polarization and exchange being taken into account. The phenomenon of polarization in exchange has, however, been ignored in calculating the zero-order phase shift. An endeavor was made to study this collision at 0.04 eV by approximating the polarization potential proposed by H. Reeh [Z. Naturforsch., 15a: 377(1960)]. It was found that the computed scattering phase shifts and cross sections are in fair accord with the experimental results. (auth)

986 CROSS SECTIONS FOR ENERGY TRANSFER IN CLASSICAL COULOMB COLLISIONS. deBoer, P. C. T. (Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belg.). Phys. Rev., A; 1: 1631-5(Jun 1970).

The cross section Q(U) for energy transfer of at least U is given for the case where the incident particle is lighter than the target particle. Complete results for Q(U) are represented with the aid of a diagram, the coordinates of which are nondimensionalized mass and nondimensionalized energy of the target particle. Some remarks are made about scaling laws for direct excitation. (auth)

987 OSCILLATION OF THE CHARGE EXCHANGE CROSS SECTIONS IN THE Na^+–Ne SYSTEM. Latypov, Z. Z.; Shaporenko, A. A. (Ioffe Inst. of Physics and Tech., Leningrad). JETP Lett. (USSR) (Engl. Transl.); 12: 123-5(20 Aug 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 177-81(20 Aug 1970).

The effective cross section of the charge-exchange process $Na^+ + Ne \rightarrow Na + Ne^+$ was investigated at Na^+ kinetic energies of 400 to 2500 eV. The observed oscillations of the charge-exchange cross section as a function of ion energy are compared with previously observed oscillations of the excitation cross section for the process $Na^+ + Ne \rightarrow Na^+ + Ne^*$. Both cross sections are discussed in terms of the possible formation and properties of a quasi molecule $NaNe^+$. (A.G.W.)

988 SPECTRA OF N_2 EXCITED BY PROTON BOMBARDMENT. Ghosh, S. N.; Sahai, Y.; Bhutani, K. K. (Univ. of Allahabad, India). Indian J. Pure Appl. Phys.; 6: 146-7(Mar 1968).

N_2 spectra excited by protons of energies in the range 0.56 to 1.7 keV at different N_2 pressures (5 to 30 μ) were studied. Spectroscopic analysis shows that in the region 2900 to 7000 A, the spectra contain 1PG and 2PG systems of N_2, 1NG system of N_2^+, and H_α and H_β lines. No change in the nature of the spectra was observed with change in proton energy. Photometric observations show that the light intensity for the 1NG system of N_2^+ varies linearly with the gas pressure while for the 2PG system of N_2 variation is quadratic. The relative band intensities for different progressions and sequence of N_2 and N_2^+ were calculated microphotometrically. Mechanisms for these excitations are proposed. (auth)

989 CORRELATION EFFECT ON A DOUBLE TRANSITION INDUCED BY FAST ELECTRONS. Wiebes, G. (FOM–Instituut voor Atoom- en Molecuulfysica, Amsterdam). Physica; 48: 407-13(31 Aug 1970).

The correlation effect on a double transition in the Born approximation is demonstrated by calculating the asymptotic parameters for the cross section of the process e + He $(1s)^2\ ^1S \rightarrow$ e + He (2s2p) ^1P, using various initial- and final-state wave functions. When passing from a Hartree–Fock ground-state wave function to one that represents correlation in the crudest way, the oscillator strength of the transition is decreased by a factor of six, while the decrease of the generalized oscillator strength as a function of the momentum transfer K is much slower. The interaction between the configurations (2s2p) ^1P and (2p3d) ^1P in the construction of the (auto-ionizing) level (2s2p) ^1P produces a rise of the oscillator strength of this level. This is an analog of the more pronounced example of the interaction between the configurations (2snp) and (ns2p) in the construction of the so called $(2snp)^+$-level, which is well known from literature. (auth)

990 ELECTRON CAPTURE INTO EXCITED STATES BY HELIUM IONS INCIDENT ON NOBLE GASES. Wolterbeek Muller, L.; De Heer, F. J. (FOM–Instituut voor Atoom- en Molecuulfysica, Amsterdam). Physica; 48: 345-96(31 Aug 1970).

Capture of an electron into an excited state by helium ions incident on helium, neon, argon, krypton, and xenon in the energy range of 0.3 to 150 keV was studied experimentally. Cross sections were determined for capture into singlet and triplet He I levels with principal quantum numbers n varying between 3 and 6 by means of observation of the resulting emission of light. Pronounced oscillations are found in the cross sections, especially for He^+ on He and Ne. If the oscillations for He^+ on He for capture and excitation leading to the same final excited state on the projectile or the target atom are compared, then these oscillations often have an antiphase for capture and excitation. This is explained by the interference of gerade and ungerade scattering in the intermediate excited He_2^+ molecule-ion. Oscillations in excitation + capture cross sections for He^+ on He and in capture cross sections for He^+ on other atoms may be related to pseudo curve crossing of potential curves in intermediate molecular complexes and resulting interference effects between different modes of scattering. (auth)

991 MEASUREMENTS OF VERY-SMALL-ANGLE SCATTERING OF MEDIUM-ENERGY ELECTRONS IN GASES. Lord, R. G. (Oxford Univ.). J. Phys., D (London); 3: 1480-5 (Oct 1970).

The total scattering cross sections of helium, nitrogen, and argon for 13-, 23-, and 43-kV electrons were measured in the angular range up to 6 mradians. The results are compared with theoretical cross sections based on Hartree and Hartree–Fock atomic models. Agreement is found to be quite good for helium, but for the other two gases the measured cross sections are smaller than predicted on the basis of the Raman–Compton theory of inelastic scattering. This is believed to be due to the neglect of exchange terms in calculating the inelastic cross sections. (auth) (UK)

992 REACTIONS OF EXCITED ATOMS AND MOLECULES WITH ATOMS AND MOLECULES. IV. DETERMINATION OF INTERACTION POTENTIALS FROM PENNING ELECTRON ENERGY DISTRIBUTIONS. Hotop, H.; Niehaus, A. (Univ., Freiburg i. B.). Z. Phys.; 238: 452-65(1970).

Penning electron distributions arising from the ionization of Na and K by He(1s2s $^{1,3}S$) metastables in thermal collisions, as well as the absolute cross section for Penning ionization of Na by He(2 ^3S) and relative cross sections for ionization of Na and K by He(2 ^1S) and He(2 ^3S) are measured. It is shown that under fairly general conditions the well depth ϵ^* of the interaction potential between the metastable and the target particle can be obtained directly from the measured electron distributions. ϵ^* values are reported for the molecules He(1s2s $^{1,3}S$)–Na(^2S), K(^2S)($^{2,2}\Sigma$), and for He(1s2s $^{1,3}S$)–Hg(^1S)($^{1,3}\Sigma$). These latter values are obtained from previously published measurements and are to be considered preliminary. Further, additional evidence is given, that Penning ionization with metastables is an electron-exchange process. (auth)

993 EMISSION CROSS SECTION FOR THE FIRST NEGATIVE BAND SYSTEM OF OXYGEN PRODUCED BY ELECTRON IMPACT. Srivastava, B. N. (Univ. of Alaska, College). J. Quant. Spectrosc. Radiative Transfer.; 10: 1211-17(Nov 1970).

The absolute cross section for the emission of the first negative bands of O_2^+ under electron impact on oxygen was measured using photon-counting techniques. The measured cross sections are free from polarization effects. At 100 eV electron energy, the emission cross sections for the (0, 0), (1, 0), and (2, 0) bands were found to be 2.4×10^{-18} cm^2, 3.67×10^{-18} cm^2, and 1.37×10^{-18} cm^2, respectively. The emission cross section ratios are in reasonable agreement with the proton impact excitation measurement. (auth) (UK)

994 STUDY OF PROTON CHARGE EXCHANGE WITH FORMATION OF EXCITED STATES. Le Doucen, Roger; Lenormand, Jean-Michel; Guidini, Joseph (Rennes Univ., France. EURATOM–CEA, Fontenay-aux-Roses, France). Compt. Rend., Ser. B; 271: 437-40(24 Aug 1970). (In French).

The charge exchange of protons with electron capture into the excited states $n \geq 9$ was studied at energies between 20 and 150 keV. (auth) (France)

995 ELECTRON-IMPACT EXCITATION OF THE He $1^1S \rightarrow 2^3S$, $1^1S \rightarrow 2^3P$, AND $1^1S \rightarrow 2^1P$ TRANSITIONS. Steelhammer, J. C.; Lipsky, Sanford (Univ. of Minnesota, Minneapolis). J. Chem. Phys.; 53: 4112-14(15 Nov 1970).

Differential cross sections for excitation of helium by impact of 55.5-eV electrons were calculated using the Born–Oppenheimer (BO) approximation. Results for the 1^1S-2^1P transition are compared with calculations based on the Born–Ochkur–Rudge approximation. Approximate agreement of the two calculations indicates that the core contribution remains relatively unimportant even at large angles. Cross sections for the 1^1S-2^3P and 1^1S-2^3S transitions were also calculated by the BO approximation. In all three cases disagreement of the results with experimental data at large angles suggests the inadequacy of the first Born approximation at large momentum transfers. (A.G.W.)

996 ABSOLUTE ELECTRON COLLISION CROSS SECTIONS FOR TWO FORBIDDEN TRANSITIONS IN NITROGEN AT KINETIC ENERGIES OF 300 TO 500 eV. Skerbele, Ausma; Lassettre, Edwin N. (Carnegie-Mellon Univ., Pittsburgh). J. Chem. Phys.: 53: 3806-13(15 Nov 1970).

Absolute differential electron collision cross sections and generalized oscillator strengths were measured for two forbidden transitions, a $^1\Pi_g \leftarrow X\ ^1\Sigma_g^+$ and a$'\ ^1\Sigma_g^+ \leftarrow X\ ^1\Sigma_g^+$, in N_2. These measurements were carried out at electron kinetic energies of 300, 400, and 500 eV and at small scattering angles (θ = 2 to 6°) to facilitate extrapolation to zero momentum change. The Born approximation apparently holds for the excitation of the first transition but not for the second. Generalized oscillator strengths, however, extrapolate to the optical oscillator strength (zero) in both cases in accord with the limit theorem previously demonstrated. (auth)

997 FURTHER SELECTION RULES FOR EXCITATION BY ELECTRON IMPACT AT SMALL MOMENTUM CHANGES. Lassettre, Edwin N. (Carnegie-Mellon Univ., Pittsburgh). J. Chem. Phys.: 53: 3801-5(15 Nov 1970).

At kinetic energies in the range 300 to 500 eV, there is an accumulation of experimental evidence that the Born approximation does not hold when term symbols are the same in the initial and final states. It is shown here that deviations from the Born approximation at small momentum changes are proportional to a series of matrix elements of operators, the first (and dominant) term involving an operator that is invariant under the operations of the symmetry group of the scatterer. This accounts for the observation in the first sentence above. Selection rules for the next term in the series are also discussed. (auth)

998 INTERACTION PHENOMENA IN IONIZATION PROCESSES. Morrison, J. D.; Traeger, J. C. (La Trobe Univ., Bundoora, Australia). J. Chem. Phys.: 53: 4053-8(15 Nov 1970).

It is suggested that, in several instances, ionization of atoms and molecules by photon and electron impact may exhibit an interaction phenomenon, whereby the lower-charged or parent ion cross section decreases at the appearance energy of the multiply charged or fragment ion. This competition between cross sections is first interpreted in terms of configuration interaction and then in relation to a collision complex model, similar to the compound nucleus model used to describe nuclear excitation processes. (auth)

999 INTRA- AND INTERMOLECULAR VIBRATIONAL DE-EXCITATION IN IMPULSIVE ATOM–DIATOMIC MOLECULE COLLISIONS. Kelley, J. Daniel (McDonnell Douglas Corp., St. Louis). J. Chem. Phys.: 53: 3864-8(15 Nov 1970).

The de-excitation of vibrationally energetic Morse oscillators via impulsive collision with an atom is discussed. In certain types of atom–oscillator systems intramolecular vibration-to-rotation energy transfer is more important than intermolecular vibration-to-translation transfer. Since the efficiency of this intramolecular de-excitation has a different dependence on particle mass and collision energy than does the intermolecular de-excitation, restricting consideration to the latter, e.g., using a collinear collision model, does not always lead to an adequate description of the de-excitation process. (auth)

1000 ATOMIC COLLISION PHENOMENA IN GASES: SOME MODERN ASPECTS. Gilbody, H. B. (Queen's Univ., Belfast). Contemp. Phys.; 11: 541-58(Nov 1970).

Some aspects of atomic and molecular collision phenomena in gases, interest in which has expanded enormously over the past two decades, are reviewed. A general description of some of the many different collision processes and the experimental methods used to investigate them are included. The importance of these processes in a number of practical situations is also discussed. (auth) (UK)

1001 DIFFERENCE BETWEEN RELATIVISTIC AND NON-RELATIVISTIC TREATMENTS OF LOW-ENERGY ELECTRON SCATTERING FROM MERCURY. Walker, D. W. (Univ. of Melbourne). J. Phys., B (London): 3: L123-5(Oct 1970).

Results of nonrelativistic and relativistic calculations of cross sections for elastic electron scattering from mercury at energies from 0.25 to 8 eV, both with and without inclusion of exchange effects, are presented. It is shown that the large differences between relativistic and non-relativistic results noticed by other authors are due to neglect of exchange. (auth) (UK)

1002 NOTE ON THE OFF-SHELL COULOMB T-MATRIX. Roberts, M. J. (Univ. of Stirling, Scotland). J. Phys., B (London): 3: L115-17(Oct 1970).

A form of the off-shell Coulomb T-matrix is presented, which contains classical path sums. A correspondence identity results as the energy shell is approached. (auth) (UK)

1003 ELECTRON DETACHMENT FROM H^- IONS BY ELECTRON IMPACT. Peart, B.; Walton, D. S.; Dolder, K. T. (Univ. of Newcastle upon Tyne, Eng.). J. Phys., B (London): 3: 1346-56(Oct 1970).

A crossed-beam method was used to measure cross sections for $H^- + e \rightarrow H + 2e$ for interaction energies between 12 and 1000 eV. For energies greater than 40 eV there is excellent agreement with measurements of Dance, Harrison and Rundel and when the energy exceeds 200 eV, the measurements confirm calculations by Inokuti and Kim based on Bethe's approximation. No evidence of structure was found in the detachment function. (auth) (UK)

1004 DIFFERENTIAL CROSS SECTIONS FOR ELASTIC SCATTERING, RESONANT CHARGE EXCHANGE AND EXCITATION IN LOW-ENERGY PROTON–HYDROGEN COLLISIONS. McCarroll, R.; Piacentini, R. D. (Observatoire de Paris-Meudon, France). J. Phys., B (London): 3: 1336-45(Oct 1970).

The H^+-H collision is investigated using the three-state molecular expansion, which takes account of the coupling between $2p\sigma$ and the $2p\pi$ states of the H_2^+ quasi molecule. Differential cross sections for direct elastic scattering, resonant charge exchange, and direct and exchange excitation of H(2p) are computed for a range of incident proton energies from 150 eV to 2.84 keV and for a range of scattering angles from 0 to 10° (in laboratory system). The agreement with the experimental results is excellent. The nature of nonadiabatic effects in low-energy H^+-H collisions is discussed in detail. (auth) (UK)

1005 ELASTIC SCATTERING OF ATOMS BY ATOMS. Pope, R. L.; Tassie, L. J. (Australian National Univ., Canberra). J. Phys., B (London): 3: 1321-5(Oct 1970).

A simple closed form is obtained for an approximation to the differential cross section for the elastic scattering of atoms by atoms, by an extension of the methods used by Massey and Mohr (1933, 1934) to calculate the total elastic cross section. Comparison is made with the accurate phase-shift calculations of Bernstein and with the experimental results of Hofstetter and Bernstein. (auth) (UK)

1006 PENNING IONIZATION: $He(2^3S)$–$H(1^2S)$ COLLISIONS. Bell, K. L. (Queen's Univ., Belfast). J. Phys., B (London): 3: 1308-14(Oct 1970).

Quantal calculations are carried out on the rate at which the electronic transitions involved in $He(2^3S) + H(1^2S) \rightarrow He(1^1S) + H^+ + e$ occur. An impact parameter formulation is then employed to determine the rate coefficient for the process. At thermal temperatures the value obtained is $7.5(\pm 20\%) \times 10^{-10}$ cm^3 sec^{-1}. (auth) (UK)

1007 QUANTUM-MECHANICAL PHASE-INTERFERENCE EFFECTS IN LOW-ENERGY He^+–Ne AND Ne^+–He INELASTIC COLLISIONS. Tolk, N. H.; White, C. W.; Dworetsky, S. H.; Farrow, L. A. (Bell Telephone Labs., Whippany, N. J.). Phys. Rev. Lett.; 25: 1251-4(2 Nov 1970).

Total relative emission cross sections for the production of He I, Ne I, and Ne II radiation were measured as a function of energy in low-energy He^+-Ne and Ne^+-He collisions. These are the first ion–atom excitation measurements of atomic states populated through two different incoming pseudomolecular-potential curve channels. The oscillatory structure in the He^+-Ne data can be explained in terms of phase-interference effects between potential curves at pseudocrossings occurring at large internuclear distances. (auth)

1008 VIBRATIONAL AND ROTATIONAL EXCITATIONS OF HD^+ BY COLLISION WITH POSITIVE IONS. Watanabe, Tsutomu; Koike, Fumihiro; Tsunematsu, Toshihide (Tokyo Univ.). J. Phys. Soc. Jap.; 29: 1335-40(Nov 1970).

Dipole-type vibrational and rotational excitations of a molecular

ion by positive-ion impact are theoretically investigated. Semiclassical treatment with hyperbolic (Coulombic) trajectory is employed. Cross sections for the vibrational and rotational excitations of HD^+ are evaluated in the case of low incident energies as a typical example. The mechanism of the process is considered to be the effect of the time-dependent electric field induced by the motion of incident ions. The maximum cross section for the vibrational excitation from the ground to the first excited state is estimated to be 11 a_0^2 (square of Bohr radius) at 40-eV proton impact. For the rotational excitation from the ground to the first excited state, the total cross section is estimated to exceed 200 a_0^2 for proton impact at energies more than 1.3 eV. The comparison with the straight line trajectory approximation is made and the validity of the semiclassical approximation is discussed. (auth)

1009 ENERGY OF PARTIALLY IONIZED MATTER. Zink, J. W. (Univ. of California, Livermore). Astrophys. J.; 162: 145-51(Oct 1970).

A Thomas–Fermi (TF) calculation of the energy of partially ionized matter involves an evaluation of the energy of the electron–nuclear interaction by means of the TF electron density. The TF electron density is particularly unrealistic in the region near the nucleus where the potential is large. The result is that TF calculations of the energy can be substantially in error. In addition to this problem, the TF method does not include the effects of shell structure in detail. A more quantum-mechanical method can be used to find the energy of the electron–nuclear interaction and to show the effects of shell structure. This method makes use of the eigenvalues associated with the TF potential. (auth)

Atomic Theory

Refer also to abstracts 1580 and 1744.

1010 PHASE–AMPLITUDE METHOD IN ATOMIC PHYSICS. I. BASIC FORMULAS FOR AN ELECTRON IN AN IONIC POTENTIAL. Dehmer, J. L.; Fano, U. (Univ. of Chicago). Phys. Rev., A; 2: 304-9(Aug 1970).

The radial Schrödinger equation for a modified Coulomb field is separated into two first-order equations for a "phase" function and an "amplitude" function, which vary only in the non-Coulomb region $r < r_0$. At $r = r_0$, these functions are related to the mixing parameter and normalization constant of quantum-defect theory. Integrals over the range $[0, r_0]$ give the scattering phase shift and the wave function's amplitude near the nucleus. Phase shifts for negative energies serve to calculate the discrete eigenvalues of an atom or positive ion. A numerical procedure for this approach is outlined. (auth)

1011 COHERENT SPONTANEOUS EMISSION. Bonifacio, Rodolfo; Preparata, Giuliano (Harvard Univ., Cambridge, Mass.). Phys. Rev., A; 2: 336-47(Aug 1970).

Coherent spontaneous emission from a system of N two-level atoms interacting with a quantized radiation field is treated for the case in which Dicke's "cooperation number" r is macroscopically large. It is shown how to modify the quasiclassical approach to this problem to incorporate quantum effects that are lost in the self-consistent-field approximation. The statistics of the emitted radiation are found to vary markedly with the initial state of the system of atoms. The photon statistics tend to that typical of blackbody radiation when the initial state of the atomic system is that which would result from incoherent pumping ($m \sim r$). When, on the other hand, the atoms are initially in a superradiant state ($m \ll r$), the emitted radiation may be represented approximately by a coherent state. (auth)

1012 SINGLE-CENTER VARIATIONAL CALCULATIONS WITH BASIS FUNCTIONS DEPENDING ON r < AND r >. Anderson, Alfred B.; Parr, Robert G. (Johns Hopkins Univ., Baltimore). J. Chem. Phys.; 53: 4098-4100(15 Nov 1970).

It is shown that the four-parameter one-electron radial functions $f(r,R) = r^{\xi} < \exp(-J_< r_<) r^{\eta} > \exp(-\zeta_> r_>)$, where $r_<$ and $r_>$ are the lesser and greater of an electronic coordinate r and a nuclear coordinate R, may be used profitably in the single-center method for determination of electronic wave functions. Results (parameters and energies) are given for the H 1s state, the H_2^+ ground state, and H_2. (A.G.W.)

1013 PERTURBATION ENERGIES FOR THE HOOKE'S LAW MODEL OF THE TWO-ELECTRON ATOM. Benson, John M.; Brown, W. Byers (Univ. of Wisconsin, Madison). J. Chem. Phys.; 53: 3880-6(15 Nov 1970).

The Rayleigh–Schroedinger perturbation energies $E^{(n)}$ for the ground state of the Hooke's law model atom are calculated through tenth order. The $E^{(n)}$ are expressed as singly infinite sums whose terms are obtained from recurrence relations. Very slow convergence limited the method to $E^{(10)}$ and below. The results are compared with those of Midtdal (1965) for helium-like atoms, and it appears that the convergence of the Hooke series is more rapid. However, no recognizable patterns are observable in the Hooke $E^{(n)}$ through $E^{(10)}$. The nature and position of the singularity determining the radius of convergence is discussed. (auth)

1014 PERTURBATION THEORY OF THE HOOKE'S LAW MODEL FOR THE TWO-ELECTRON ATOM. White, Ronald J.; Brown, W. Byers (Univ. of Wisconsin, Madison). J. Chem. Phys.; 53: 3869-79(15 Nov 1970).

The Hooke model for the two-electron atom replaces the electron–nuclear interaction by a harmonic oscillator potential, but retains the Coulomb repulsion of the electrons. The first-order perturbation equation for the electron repulsion is solved analytically, and the exact first-, second-, and third-order perturbation energies are obtained. A similar Z^{-1} perturbation treatment is carried out for the Hartree–Fock equation and other variational approximations. The Z^{-1} expansion of the correlation energy is compared with that for helium-like atoms and found to be similar. (auth)

1015 CONSTRAINED-VARIATION METHOD APPLIED TO HELIUM-ATOM WAVE FUNCTIONS. Whitman, Donald R.; Carpenter, Richard N. (Case Western Reserve Univ., Cleveland). J. Chem. Phys.; 53: 3830-2(15 Nov 1970).

The constrained-variation method is applied to helium-atom wave functions, using precise Pekeris values of electron moments both as constraints and as tests of the effectiveness of the method. The conclusions support the basic premise that constrained-variation wave functions may better represent the true electron densities in a system than do the corresponding free-variation functions. (auth)

1016 QUANTUM TRANSITIONS BETWEEN HIGHLY EXCITED ATOMIC LEVELS INDUCED BY EXTERNAL TIME-DEPENDENT FORCES. Presnyakov, L. P.; Urnov, A. M. (Lebedev Inst. of Physics, Moscow). J. Phys., B (London); 3: 1267-71 (Oct 1970).

A model of an excited quantum system is considered. An exact solution is obtained for a nonstationary problem in which the interaction potential is an arbitrary function of time and coordinates. The obtained solution reduces in particular cases to well-known results for transition probabilities between highly excited levels of a quantum oscillator. (auth) (UK)

1017 PERTURBATION TREATMENT OF THE EXTENDED HARTREE–FOCK EQUATIONS FOR $2s^2\ ^1S$ AND $2p^2\ ^1S$ WEAKLY QUANTIZED STATES OF HELIUM-LIKE IONS. Sharma, C. S.; Wilson, R. G. (London Univ.). J. Phys., B (London); 3: 1279-83(Oct 1970).

The first-order extended Hartree–Fock (EHF) equations for the $2s^2\ ^1S$ and $2p^2\ ^1S$ states of two-electron atomic systems are solved exactly. The solutions are used to evaluate the second-order EHF energies exactly and the third-order EHF energies with great accuracy. The EHF equations of these states correctly take into account the zero-order mixing of the wave functions and are comparable in accuracy to the conventional HF equations for nondegenerate states. The results are compared with those of experiment and of other calculations. (auth) (UK)

1018 PERTURBATION THEORY FOR THE RELATIVISTIC HARTREE–FOCK EQUATIONS FOR ATOMS. I. THE GENERAL THEORY. Sharma, C. S.; Bowtell, G. (London Univ.). J. Phys., B (London); 3: 1272-8(Oct 1970).

A perturbation theory is developed for the relativistic Hartree–Fock equations for atoms with particular reference to the ground state of a helium-like atom. It is expected that the method developed here, in conjunction with the perturbation theory for the nonrelativistic Hartree–Fock equations, will provide a powerful tool for the study of the extranuclear properties of heavy atoms. (auth) (UK)

1019 INTEGRALS INVOLVING CONTINUUM WAVEFUNCTIONS. I. ONE-CENTER COULOMB INTEGRALS. Bottcher, C. (Harvard Coll. Observatory, Cambridge, Mass.). J. Comput. Phys.; 6: 237-46(Oct 1970).

Integrals required in the application of variational principles to the scattering of electrons by atoms are reviewed, special attention being paid to the case of a Coulomb field. A technique is described for the evaluation of integrals involving two continuum functions. (auth)

1020 NOTE ON SIMPLE APPROXIMATIONS OF EXCHANGE AND SELF-INTERACTION EFFECTS IN CALCULATIONS BY SCF METHODS. Schwarz, W. H. Eugen (Univ., Bonn). Z. Phys.; 239: 162-7(1970). (In German).

Exchange and self-interaction energies of atoms (E_A and E_S

resp.) both differ from the statistical free electron gas values rather considerably (by a factor of about 2). This discrepancy, as the known and similar one in correlation energy, is caused by the localization of the atomic electrons in the field of the nucleus. Compensation of errors in E_A and E_S allows the simple statistical model satisfactorily to account for exchange, contrary to atomic correlation. A Thomas–Fermi–Dirac model with modified exchange and self-interaction terms leads to an improved description of matter under very high pressure, similar to the improved results of an analogously modified Hartree–Fock–Slater model. (auth)

Cosmic Radiation

Refer also to abstracts 180, 385, 428, 429, 861, 1079, 1358, 1377, 1382, and 1402.

1021 (N–70–32990) [COSMIC RAY MEASUREMENTS]. Final Report. Frye, Glenn M. Jr. (Case-Western Reserve Univ., Cleveland, Ohio. Dept. of Physics). 20 May 1970. Contract NAS9-4411. 49p. (NASA-CR–108559). NTIS.

In a search for cosmic gamma radiation above 50 MeV, 60% of the northern hemisphere was surveyed on four balloon flights at 2.5 mbar. Gamma rays were detected by the electron–positron pairs produced in the plates of a 30-gap spark chamber sensitive from 50 MeV to 2 GeV, and having an angular resolution of 2.6° and an HWHM acceptance angle of 20°. (auth) (STAR)

1022 (N–70–35591) COSMIC RAY SEARCH FOR FAST MAGNETIC CHARGES. Tompkins, Donald R. (Georgia Univ., Athens. Dept. of Physics). Jul 1970. 12p. (NASA-CR–112504). NTIS.

A discussion of a method for observing and studying the monopoles of cosmic rays is given. This method includes primary and secondary monopoles of all allowable magnetic charge values. Also this method proposes to set new monopole production cross section limits. It suggests that Cherenkov counter telescope be used and night sky photography be studied in order to determine whether relativistic monopoles produce straight lightning strokes. (STAR)

1023 AZIMUTHAL TELESCOPE AUTOMATICALLY REGISTRATING THE MESON COMPONENT OF COSMIC RADIATION INTENSITY. Chaloupka, P.; Siska, P. (Inst. of Physics, Kosice, Czech.). Fyz. Cas.; 19: 118–28(1969). (In Slovak).

The azimuthal telescope built in 1966–67 by the cosmic radiation group at the Slovak Academy of Sciences is described. It is used to measure the meson component intensity variations of cosmic radiation in eight azimuthal directions and in the vertical direction. The sensing part of the azimuthal telescope consists of four identical standard G–M tube telescopes with cubic geometry. In each telescope, 10 G–M tubes form the bottom base of a cube and 10 tubes the upper base. The geometry of the azimuthal telescope is determined by four such telescopes with a common vertical edge. Between the two rows of G–M tubes a lead plate of 10 cm thickness is placed. A detailed description is given of all electronic circuits, i.e., the input circuit, pulse-shaping circuit, and supply circuit. The functioning of the recording device is given in some detail. (NSA of Czech.)

1024 IMPROVED EXPERIMENTAL ARRANGEMENT TO STUDY GEOMAGNETIC EFFECT OF EXTENSIVE AIR SHOWERS. Rao, A. Bhaskara (Indian Inst. of Tech., New Delhi); Gill, P. S. Indian J. Pure Appl. Phys.; 6: 307-11(1968).

An improved experimental setup using two GM counter telescopes in conjunction with three core selectors (P-sets) for the study of the geomagnetic effect of extensive air showers (EAS) is described. The arrangement can be utilized for determining the relative role of electron and μ-meson components in the geomagnetic effect of EAS. It can also be used to evaluate the geomagnetic effect as a function of the zenith angle of the secondary shower particles. Some of the merits of the setup are discussed. (auth)

1025 UPPER LIMIT TO THE PRIMARY DEUTERON FLUX AND PATH LENGTH IN SPACE. Puri, R. K.; Aditya, P. K.; Jha, S. K. (Indian Inst. of Tech., New Delhi). Indian J. Pure Appl. Phys.; 8: 356-8(Jun 1970).

An emulsion stack, exposed near the geomagnetic equator during the period of minimum solar activity, was used to estimate an upper limit for the flux of primary deuteron nuclei, by identifying the possible deuteron-induced interactions among the samples of interactions induced by singly charged particles; a value of 2 particles/m^2 ster sec was obtained. An attempt was made to estimate the path length on the basis of diffusion and regular models of propagation. (auth)

1026 IMPLICATIONS OF THE OBSERVED SOLAR MODULATION OF COSMIC-RAY ELECTRONS. Burger, J. J. (Kamerlingh Onnes Laboratorium, Leiden); Tanaka, Y. Astrophys. J.; 162: 305-14(Oct 1970).

The observed variation of the primary-electron intensity above 500 MeV between 1966 and 1968 is compared with those of protons and α-particles. The modulation feature of these three components is consistent with the simple diffusion–convection theory. On the other hand, a generalized diffusion–convection theory developed by Gleeson and Axford which includes effective energy losses does not explain simultaneously the modulation of the three different species. The disagreement may imply that the effect of energy loss is insignificant in accounting for the solar modulation. The interstellar-electron spectrum is derived by using the simple diffusion–convection theory, under the assumption that the cosmic-ray diffusion coefficient is a separable function of heliocentric radius and rigidity. Comparison of the result with the nonthermal galactic radio spectrum, and also the observed positron flux indicate a significant underestimate of the modulation below 1 GeV. This casts serious doubt on the separability of the diffusion coefficient. (auth)

1027 EFFECT OF IONIZATION LOSSES ON SPECTRUM OF COSMIC RAYS ACCELERATED IN SOURCES. Velinov, P. (Inst. of Geophysics, Sofia). Compt. Rend. Acad. Bulg. Sci.; 23: 371-4(1970).

From formulae developed earlier, values for C/α, ratio of parameters of ionization loss to acceleration, are presented for the solar chromosphere, interstellar space, supernovae, radio galaxies, and quasars. The problem of determining the spectrum of cosmic particles accelerated in these regions during propagation is considered. Formulae derived correspond with results obtained by Ginzburg in his book, Progress in Elementary Particles and Cosmic Ray Physics (Amsterdam, North-Holland Publishing Co., 1968). (J.C.W.)

1028 SPALLATION LIMITS ON INTERSTELLAR FLUXES OF LOW-ENERGY COSMIC RAYS AND NUCLEAR GAMMA RAYS. Fowler, William A. (California Inst. of Tech., Pasadena); Reeves, Hubert; Silk, Joseph. Astrophys. J.; 162: 49-56(Oct 1970).

Limits on the interstellar flux of low-energy cosmic rays derived from a recent interpretation of the stellar Li, Be, and B abundances are used to evaluate the possible effects of fast particles in the interstellar medium. It is shown that low-energy cosmic rays of energy exceeding 5 MeV per nucleon can account neither for the heating of H I regions, nor for the alignment of interstellar grains, nor for the galactic enhancement in the diffuse x-ray flux, if the latter has a nonthermal bremsstrahlung origin. The flux of nuclear γ-rays in the galactic plane is evaluated, and found to be comparable in intensity to the extrapolated diffuse x-ray flux in the vicinity of 1 MeV. (auth)

1029 STUDIES OF NUCLEAR COMPONENT OF COSMIC RAYS DURING THE PERIOD OF MINIMUM SOLAR ACTIVITY. Kurnosova, L. V.; Logachev, V. I.; Razorenov, L. A.; (and others). Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 226-56(1970). (In Russian).

Data are given on various cases in which the increase of nuclear intensity resulted in an increase of intensity of heavier nuclei which were, in all probability, produced on the sun. Theoretical interpretations are given based on the concept of possible existence of a mechanism of acceleration of heavy ions on the sun. Variations related to the modulations of primary galactic cosmic rays are investigated. During the minimum of solar activity these variations are small and can be evaluated statistically. The problem of the flux of super-heavy nuclei with $Z > 30$ charge are, also, discussed. (tr-auth)

1030 EFFECT OF SCATTERED PHOTONS ON SPECTRUM OF DIFFUSE X RAYS OBSERVED AT BALLOON ALTITUDE. Makino, F. (Nagoya Univ., Japan). Astrophys. Space Sci.; 8: 251-5(Aug 1970).

Effect of the scattering of cosmic diffuse x rays in the atmosphere on the observed spectrum at balloon altitude is examined. It is shown that the contribution of the scattered x rays cannot be eliminated by the usual method of extrapolating the growth curve and that the atmospheric absorption of the primary x rays has been overcorrected thus far by 25 to 40%. (auth)

1031 COHERENT RADIO EMISSION FROM COSMIC-RAY AIR SHOWERS IN THE TURBULENT ATMOSPHERE. Lerche, I. (Univ. of Chicago). Astrophys. Space Sci.; 8: 185-203(Aug 1970).

Coherent electromagnetic Cherenkov radiation is produced by cosmic-ray air showers passing through the atmosphere. This radiation is detected by radio telescopes. It is demonstrated that the effect of random spatial fluctuations in the refractive index

of air, about a mean exceeding unity, causes the air shower to emit not only the spontaneous coherent radio emission described elsewhere by Kahn and Lerche, but also an induced radiation field which can exceed the spontaneous field in certain frequency bands. Further the conditions for emission of the coherent radio Cherenkov radiation are altered by the presence of the refractive index fluctuations. And the Earth's magnetic field gives rise to the dominant term in the far-field radiation, be it spontaneous or induced, since it causes a systematic separation of electrons and positrons in the shower which, for parameters currently acceptable for air showers, is the major factor in determining the far-field radiation pattern. Also it is suggested that the coherent 500-Mc radiation seen from occasional showers is probably a reflection of an atmospheric correlation length of order 15 cm at the time the shower passes through the atmosphere. (auth)

1032 GENERATION OF CHERENKOV LIGHT FLASHES BY COSMIC RADIATION WITHIN THE EYES OF THE APOLLO ASTRONAUTS. Fazio, G. G. (Harvard Coll. Observatory, Cambridge, Mass.); Jelley, J. V.; Charman, W. N. Nature (London); 228: 260-4(17 Oct 1970).

It is proposed that the primary cosmic radiation is responsible for the light flashes observed by astronauts in translunar flight. Cherenkov radiation may be an important or even the dominant mechanism for this effect. An alternative mechanism is the direct excitation of the retina by cosmic-ray particles. (auth) (UK)

Direct Energy Conversion

Refer also to abstract 733.

1033 CALCULATING THE MAGNETIC FIELD IN THE ACTIVE ZONE OF DC MHD MACHINES. Mezhburd, V. I.; Reimal, L. P. Tr. Tallin. Politekh. Inst., Ser. A; No. 266, 59-72(1968). (In Russian).

The calculation of the distribution of the MHD magnetic field with a cylindrical solenoid with untight winding of the branches in the middle part of the active zone is considered. Relations derived here may be used for the determination of the current in given geometry of the solenoid, the number of its turns, etc. (auth)

1034 PROBLEMS FOR DESIGNING NUCLEAR MAGNETOHYDRODYNAMIC GENERATOR FOR POWER GENERATION. Biswas, S. K. J. Inst. Eng. (India), Elec. Eng. Div.; 48: No. 2, 159-83(1967).

Magnetohydrodynamic (MHD) systems offer a method of direct generation of electricity with overall efficiency of about 45% to 50%. MHD power is produced directly by passing plasma stream or ionized gas through a magnetic field. The principles of MHD generation, conductivity and ionization properties of the gas used, use of nuclear reactors in MHD generation, problems related to generation, and also results of the investigation in the design of nuclear reactors are discussed. (Indian Sci. Abstr.)

Fluid Physics

1035 HEAT TRANSFER TO MHD SLIP FLOW IN THE THERMAL ENTRANCE REGION OF A PARALLEL PLATE CHANNEL. Kikuchi, Kentaro (Government Mechanical Lab., Tokyo). J. Mech. Lab. Jap.; 15: No. 1, 16-22(1969).

The heat transfer to an MHD fluid in the case of uniform heat flux at the wall in the thermal entrance region of a parallel-plate channel is investigated. The channel consists of two semi-infinite parallel plates extending in X and Z directions. Electrically conducting fluid flows in the X direction, and magnetic field is imposed in the Z direction. The Hall effect and the induced magnetic field are neglected. The physical properties of the fluid are independent of temperature and are constant. The general form of the energy equation is given in simplified form for the unidirectional steady flow of the incompressible fluid with constant properties and with negligible heat conduction in the fluid flow direction. The velocity profile was first determined, and the energy equation was solved with a finite-difference method. The bulk temperature was evaluated after the temperature profile had been determined. The temperature profiles are presented in a figure. Heat transfer is discussed in relation to heat-generation parameters. (Japan)

1036 MAGNETOHYDRODYNAMIC SLIP FLOW IN THE ENTRANCE REGION OF A PARALLEL PLATE CHANNEL. I. Kikuchi, Kentaro (Government Mechanical Lab., Tokyo). J. Mech. Lab. Jap.; 15: No. 1, 1-7(1969).

The MHD flow problem in the entrance region of a parallel plate channel is reported in relation to the condition that the gas density is low enough to permit velocity slip at the wall. Constant magnetic field is applied vertically to the flow, and the initial velocity is assumed to be uniform. At a large distance downstream from the entrance, the velocity profile becomes the fully developed Hartmann profile, when slip velocity is zero. The equation of continuity and the equation of momentum are investigated under the following assumptions: pressure is uniform across the channel; the second derivative of flow velocity in the direction of flow is negligible compared to that in the direction vertical to the flow; the Hall current is not present; the effect of induced magnetic field on velocity profile is neglected; and the viscosity, density, and conductivity of the fluid are assumed to be constant. The analysis is based upon the method of linearization developed by Sparrow, Lin, and Lundgen. The velocity profiles in the fully developed region are the same as the result of Inman, and are shown in a figure. The entrance length decreases with increasing Hartmann number, and increases by the effect of velocity slip. Pressure distribution is also obtained, and it is found that the pressure gradient decreases when velocity slip is present. Wall shear stress is also calculated. (Japan)

1037 MAGNETOHYDRODYNAMIC SLIP FLOW IN THE ENTRANCE REGION OF A PARALLEL PLATE CHANNEL. 2. Kikuchi, Kentaro (Government Mechanical Lab., Tokyo). J. Mech. Lab. Jap.; 15: No. 1, 8-15(1969).

The influence of the Hall effect, fluid viscosity, and velocity slip at the wall on the entrance flow in the MHD generator channel with segmented electrodes is investigated. It is assumed that constant magnetic field is applied across the flow in the MHD parallel-plate channel, the initial velocity profile is uniform, and the velocity on the wall is proportional to the velocity gradient at the wall. The fundamental equations to be solved are Ohm's law, the continuity equation, the momentum equation, and the Maxwell equation. The analysis is based on Targ's linearization method. The calculated results of the axial variation of velocity distribution for the Hartmann number of 100 and the Hall coefficient of 100 are shown. For the fully developed condition, the result is in agreement with the solution obtained by Sutlon and Sherman. The pressure distribution and the influence of the magnetic field upon conversion efficiency are also shown. Hall effect and velocity slip increase the conversion efficiency considerably. Targ's method is better than the other method because the physical quantities of interest can be evaluated with a minimum of numerical work. (Japan)

1038 RAYLEIGH PROBLEM FOR A NON-NEWTONIAN, ELECTRICALLY CONDUCTING LIQUID. Sapunkov, Ya. G. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 50-5(Mar-Apr 1970). (In Russian)

Let the above liquid occupy a certain space $y > 0$. At time $t = 0$ the plane $y = 0$ goes into uniform motion with a velocity U along the x axis. The magnetic Reynolds number is small. The magnetic field vector is parallel to the y axis. Equations are written for the motion of the liquid and the boundary conditions. A solution of the problem is obtained for weak and strong magnetic fields. It is shown that in expanding liquids there are two regions separated by a moving boundary: a liquid at rest and a perturbed liquid. Accurate approximations can be obtained for pseudoplastic liquids, while particular solutions are approximated for expanding liquids. (TTT)

1039 DISTRIBUTION OF ELECTRICAL POTENTIAL IN A CHANNEL WITH SOLID ELECTRODES AT HIGH MAGNETIC REYNOLDS NUMBER. Konovalov, A. E. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 42-6(Mar-Apr 1970). (In Russian)

It is assumed that a nonviscous electrically conducting gas that does not conduct heat moves in a plane channel and is subjected to the action of a homogeneous, external, transverse magnetic field. The hydrodynamic properties of the gas do not vary. The upper and lower walls of the channel are the electrodes. The induced emf is balanced by the difference in potential applied to the electrodes by an external source. The change in the distribution of potential near the wall is shown for the linear problem where the perturbation in flux by the boundary conditions is small. Ionization processes in the near-electrode region and emission of electrons by the cathode are not considered. Along with slight discontinuities, a continuous change in potential is observed in a current layer of definite thickness. (TTT)

1040 NONSYMMETRIC MODEL OF A VISCOUS, ELECTROMAGNETIC LIQUID. Suyazov, V. M. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 12-20(Mar-Apr 1970). (In Russian)

The internal rotation of particles must be taken into account in liquid dielectrics and ferromagnetic liquids. The presence of magnetic degrees of freedom in magnetic particles leads to particle orientation accompanied by energy dissipation. The macroscopic behavior of such magnetized liquids is complex because

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of the simultaneous presence of mechanical, electromagnetic and thermal effects. A nonisothermal model is assumed for an isotropic, conducting polarizable liquid possessing internal particle rotation. In constructing the model the methods of thermodynamically irreversible processes are used so that with very simple and general concepts it is possible to take into account the energy dissipation of the electromagnetic field into relaxation processes associated with polarization and magnetization of the medium. The energy dissipation of the field is taken into account by considering invariant time derivates as a function of the polarization and magnetization vectors of the medium as determining parameters. (TTT)

1041 COMMENTS ON ELECTROHYDRODYNAMIC RAYLEIGH–TAYLOR BULK INSTABILITY. Barston, E. M. (New York Univ., N. Y.). Phys. Fluids; 13: 2876-80(Nov 1970).

Turnbull and Melcher (Phys. Fluids, 12: 1160(1969)) discussed the stability of an initially static, stratified perfectly insulating fluid subject to an electric stress. The author feels that their derivation of the critical field strength for instability is incorrect, and proceeds to correct and extend the analysis of their model. A rather extensive reply by Turnbull and Melcher is included. (M.O.W.)

1042 STUDY OF GRAVITY WAVES IN MAGNETOHYDRODYNAMICS. Chambarel, Andre (College Scientifique Univ., Avignon, France). Compt. Rend., Ser. A; 271: 422-4(24 Aug 1970). (In French).

A progressive gravity wave train was produced by a piston having a sinusoidal alternative motion in an electroconducting liquid. The influence of a magnetic field on the amplitude and phase velocity of this wave train was studied. The theory was compared with experiments. (France)

1043 FLOW OF A SUPERSONIC, ELECTRICALLY CONDUCTING GAS IN AN INHOMOGENEOUS MAGNETIC FIELD. Gubarev, A. V.; Degtyarev, L. M.; Samarskii, A. A.; Favorskii, A. P. Dokl. Akad. Nauk SSSR; 192: 520-3(21 May 1970). (In Russian).

In a plane channel of constant width there flows an ideal gas with finite electrical conductivity. At initial time $t = 0$, there appears an external magnetic field H. On assuming a small magnetic Reynolds number, the magnetic field H_z is an exponential function of the x coordinate. The problem is described by a set of equations of nonstationary, magnetohydrodynamics. These equations are solved by numerical methods. The distribution of Mach number, temperature, pressure, and density of the gas over the plane cross section are shown graphically at the gas entrance into the magnetic field. The calculations show that with a sharp rise in magnetic field, braking of the current by the Lorentz force takes place mainly in the compression wave localized in a narrow zone where the induced electric current is generated. Consideration of entrance of gas flow into a smoothly increasing magnetic field shows that the zone of the compression wave in this case is propagated to a distance comparable to the width of the channel, and rarefaction zones appear at the walls. On exit of the conducting gas from the magnetic field, braking and heating of the gas also take place on interaction with eddy currents. (TTT)

1044 SOME MAGNETOHYDRODYNAMIC PROBLEMS IN POROUS MEDIA. Ene, Horia I. (Univ. of Bucharest). Compt. Rend., Ser. A; 271: 569-72(21 Sep 1970). (In French).

The magnetohydrodynamic equation in porous media was described for a very general case. From this system, particular known cases can be established. For orthogonal fields, the velocity follows a linear law of the same type as the Darcy law. Results obtained for a magnetized sphere in a homogeneous porous envelope are given. (France)

Geophysics (Upper Atmosphere)

1045 (BNWL–1484) ANNUAL REPORT ON AERONOMY RESEARCH AT RICHLAND, WASHINGTON. Hoch, R. J. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug 1970. Contract AT(45-1)-1830. 218p. Dep. CFSTI.

A brief history of research on stable auroral red (SAR) arcs is presented. Results of observations of SAR arcs from Richland, Washington, during the period September 27, 1967, through March 31, 1970, are described. Twenty-three events are divided into 15 definite and eight probable SAR arcs. Typical features and behavior of the SAR arcs are described and the location of 14 arcs is shown. A record of all observations, visibility, and geomagnetic activity is appended. A first estimate of probability of SAR-arc occurrence on a given night is 0.09. (W.D.M.)

1046 (EGG–1183-3007) SOME ANALYSIS RELATING TO THE SECEDE III BARIUM RELEASE MISSIONS. Colvin, Jeff (EG and G, Inc., Albuquerque, N. Mex.). 5 Oct 1970. Contract AT(29-1)-1183. 58p. Dep. NTIS.

For Los Alamos Scientific Lab., N. Mex.

The analyses and software that were developed by EG & G Albuquerque in support of the scientific objectives of the SECEDE III high-altitude barium release missions are discussed. During these missions, cameras aboard the LASL NC-135 aircraft took photographs of the barium-ion cloud as it moved in the geomagnetic and electric fields of the ionosphere. In particular, equations are developed for 1) the position and orientation of the aircraft as a function of time, 2) the cloud position as a function of time, 3) the geomagnetic field vector at the cloud's center, 4) the sunline vector at the cloud's center, and 5) the projection of these two vectors into the plane of the film on which the cloud is photographically recorded. It is shown how the aircraft position is determined from navigation data recorded by the aircraft's inertial navigation system. The aircraft's orientation is developed as a matrix solution of successive coordinate transformations from the coordinates of three star images on a photograph of the star field background. The geomagnetic field vector is obtained from a spherical harmonic solution of Laplace's equation, and the sunline vector is interpolated from Ephemeris data. Finally, a matrix solution for successive coordinate transformations is used to obtain the vector projections in the cloud camera film plane. The remainder of the report is a standard documentation of the FORTRAN computer program developed to do these calculations. The validity of the program is demonstrated by a test run employing real data from the GUM mission, and it is shown that the computer program correctly solves the problems delineated above. (auth)

1047 EFFECT OF AUTOIONIZATION ON THE PRODUCTION RATES OF VIBRATIONALLY EXCITED O_2^+ BY SOLAR PHOTOIONIZATION. Smith, Allan Laslett (Yale Univ., New Haven). J. Quant. Spectrosc. Radiative Transfer; 10: 1129-42(1970).

The Fano configuration–interaction theory of autoionization is used to calculate the partial photoionization cross-sections for production of diatomic molecular ions in specific vibrational and electronic states. Expressions are presented which are useful in analysing photoelectron spectra when the exciting radiation (sharp lines or continuum) is in the vicinity of autoionizing states. The vibrational distribution in $O_2^+(X^2\Pi_g)$ is calculated for both a uniform excitation continuum and with the solar vacuum-ultraviolet spectrum as an excitation source; the necessary oscillator strengths and autoionization lifetimes are determined from published photoelectron, photoionization, and absorption spectra of O_2. Autoionization of the upper states of the Hopfield bands produces highly vibrationally excited ions. About 5% of the O_2^+ produced by solar photoionization have more than 1 eV of vibrational energy. (auth) (UK)

1048 EFFECT OF MAGNETIC ACTIVITY ON HORIZONTAL DRIFTS IN THE F2 REGION AT WALTAIR. Rao, P. S. Kesava; Rao, B. Ramachandra (Andhra Univ., Waltair, India). Indian J. Pure Appl. Phys.; 6: 149-50(Mar 1968).

The effect of magnetic activity on F2-region drifts at Waltair was studied utilizing the F2-region drift data taken during the period 1962–64 using the spaced-receiver method. It was found that F2-region drift velocity increases with magnetic activity. Resolving all the available drift velocities into N–S and E–W components, the effect of magnetic activity on each of these components was studied. It was found that the N–S components is towards south for K indices in the range 1 to 2.5 and towards north for higher K indices. The E–W component was found to be towards east for K indices lying between 1 and 4 and west for higher K indices. (auth)

1049 DISTRIBUTION OF POSITIVE IONS IN F REGION OF THE IONOSPHERE. Tolpadi, S. K.; Singh, R. N. (Banaras Hindu Univ., India). Indian J. Pure Appl. Phys.; 6: 176-81(1968).

The ion production rate is computed for a standard atmospheric model and by adopting the rocket and satellite measured solar flux data and corresponding ionization and absorption cross sections. Considering the various loss processes and ignoring the effects of various movements, the steady-state ion distribution in the F region is deduced. The calculated ion distribution in the height range of 140 to 300 km is compared with the available rocket and satellite data. The nature of variation of calculated ion distribution at higher levels is found to be in good agreement with the rocket and satellite measured values. However, at lower levels the data do not show good agreement. In such cases the rate coefficients for the rocket and satellite data are computed. A moderate change in the value of rate coefficients for the rocket and satellite data are computed. A moderate change in the value of rate coefficients is found to fit the experimental data. (auth)

1050 DEVIATIVE ABSORPTION IN THE F_2-LAYER Agarwal, D. C. (Univ. of Allahabad, India). Indian J. Pure Appl. Phys.; 8: 211-13(Apr 1970).

The deviative absorption (A′) in the F2 layer of the atmosphere for midlatitudes was calculated, taking into account the effects of the magnetic field. Values of A′ thus obtained were compared with those calculated by Saha [J. Atmos. Terr. Phys., 29: 1261(1967)] and experimentally measured by Sarada and Mitra [Proceedings of the IGY symposium (Council of Scientific and Industrial Research, New Delhi): 98(1962)]. It was found that the effect of the magnetic field is to reduce the value of A′ by a small amount. When the electron temperature = ion temperature = 1000°K, there is better agreement of the presently calculated values of A′ with the experimental values as compared with the values calculated by Saha. (auth)

1051 EMISSION MECHANISMS OF 5577- AND 6300-A LINES OF THE NIGHT AIRGLOW IN THE TROPICS. Agashe, V. V. (Univ. of Poona). Indian J. Pure Appl. Phys.; 6: 447-50(1968).

Various emission mechanisms suggested in the literature for the green and red emissions of atomic oxygen in the night airglow are discussed in the light of the ground observations of airglow intensities. The observed data support the Chapman reaction which is a three-body process represented as: $O + O + O \rightarrow O_2 + O^*(1s)$. However, the data do not favor stepped processes as the exclusive mechanism for the red line emission although they partially contribute to the red line intensity. Dissociative recombination appears to contribute a major share to the observed intensity of the red line. Analysis of the data indicates the possibility of a discharge mechanism for the green line emission in addition to the Chapman reaction. (auth)

1052 ION–ACOUSTIC WAVES AND RADIO AURORA. McDiarmid, D. R. (National Research Council of Canada, Ottawa). Can. J. Phys.; 48: 1863-73(15 Aug 1970).

A previously proposed model of radio aurora is developed further and is used to relate and explain data obtained during an event described by Hofstee and Forsyth. The basis of the model is the two-stream, ion–acoustic wave instability. Although the model explains this particular event very well, attempts to apply it to certain other experimental situations have resulted in unresolved difficulties. These are discussed briefly. During the Hofstee and Forsyth event, a geomagnetic bay was observed north of the scattering region. An explanation of this bay using the electric field deduced from the radio backscatter data required the assumption of a polarization field within the band of enhanced plasma associated with the visual aurora present at the same location (Boström's model 1). (auth) (Canada)

1053 AIRGLOW REACTION TO $NO + O + (M) \rightarrow NO_2^* + (M)$ AT LOW PRESSURES. Becker, K. H.; Groth, W.; Thran, D. (Univ., Bonn). Chem. Phys. Lett.; 6: 583-6(15 Sep 1970).

The pressure dependence of the airglow reaction $NO + O + (M) \rightarrow NO_2^* + (M)$ was investigated in the region of 0.1 to 50 mtorr. The results show that a radiative recombination as well as a three-body recombination is involved in the chemiluminescence. The ratios of the two-body rate constant to the three-body rate constant were measured for several added gases. At 4450 Å for most added gases a value of about 4 was obtained for the ratio of the apparent two-body rate constant of the NO_2^* chemiluminescent reaction at higher pressures to the two-body rate constant at low pressures. Because of the different spectral distribution of the NO_2^* chemiluminescence at higher pressures compared to that at lower pressures only a rough estimate of 10^{-18} to 10^{-17} cm^3 $molecule^{-1}$ sec^{-1} can be given for the rate constant of the radiative recombination of NO + O. (auth)

1054 PROPAGATION OF ELF AND VLF WAVES NEAR THE EARTH. Al'pert, Yakov L.; Fligel, Dora S. New York; Plenum Publishing Corporation (1970). 175p. $22.50.

Translation of Rasprostranenie Nizkochastotnykh Elektromagnitnykh Voln v Volnovode Zemlya-Ionosfera by James S. Wood.

Phenomena of the propagation of extremely low-frequency and very low-frequency electromagnetic waves ranging from a few hertz into the tens of thousands hertz are discussed in the following chapters: Properties of the Ionosphere at Low and Very Low Frequencies; Statement of the Problem involving the source inside the waveguide; Solution for a Sharply Bounded Homogeneous Model of the Earth-Ionosphere Waveguide; Analysis of the Pole Equation; The Electric Field Equations; Numerical Calculations of the Poles; Influence of the Interfaces; Field Amplitude, The Antipode Effect (Results of Measurements and Theoretical Calculations); Phase Spectra, Diurnal Phase Variation, and Phase Velocity; Resonance Excitation of the Earth-Ionosphere Waveguide; Influence of the Earth's Magnetic Field; Atmospherics, Propagation of Discrete Signals in the Earth-Ionosphere Waveguide; Transmission of Low-Frequency Waves through the Ionosphere in the Geomagnetic-Optical Approximation; and Propagation of Low-Frequency Waves in the Outer Ionosphere. 393 references. (J.C.W.)

1055 ON THE PITCH-ANGLE DISTRIBUTION OF ELECTRONS E > 40 keV IN THE AURORAL ZONE. Rossberg, L. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz, Ger.). Z. Geophys.; 36: 151-64(Apr 1970). (In German)

With a Nike–Apache rocket, fired into a quiet auroral arc at $\lambda = 65.3°$, the pitch-angle distribution of electron fluxes with E > 40 keV was measured. During the whole measuring time the pitch-angle distribution was isotropic for $0° < \theta < 90°$ at an electron flux of $\sim 10^3$ cm^{-2} sec^{-1} $sterad^{-1}$. This is unusual, since isotropic distributions are usually observed at higher fluxes (O'Brien, 1964; Fritz, 1967; Sharp and Johnson, 1968). The discussion of the result is based on the current knowledge of the dependence of the electron flux and its pitch-angle distribution on the geomagnetic latitude. (tr-auth)

1056 SOLAR-FLARE EFFECTS IN THE IONOSPHERE OBSERVED AT LINDAU FROM OCTOBER 27 TO NOVEMBER 2, 1968. Schwentek, H. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz, Ger.). Z. Geophys.; 36: 125-34(Apr 1970). (In German).

A heavy geomagnetic storm was recorded from October 31 to November 1, 1968. In order to facilitate a comprehensive, collating analysis of all the geophysical events that occurred during that period, the solar flare effects (SIDs) observed at Lindau in the period October 27 to November 2, 1968, are compiled and described. (tr-auth)

1057 JUNE 1965 MAGNETIC STORM: MILLSTONE HILL OBSERVATIONS. Evans, J. V. (Massachusetts Inst. of Tech., Lexington). J. Atmos. Terrest. Phys.; 32: 1629-40(Oct 1970).

Incoherent (Thomson) scatter observations are presented for the F-region electron density over the altitude range 150 to 650 km during the first 48 hr of a large magnetic storm that occurred in June 1965. These measurements, made at Millstone Hill (42.6°N, 71.5°W), are compared with measurements of the peak electron density N_mF2 and total ionospheric electron content n_t reported for a number of other stations during the same storm. It is shown that anomalously large values of N_mF2 and n_t were widely observed during the late afternoon on June 15 and 16, and that these arose because the layer was driven to a much larger height than normal. This motion coincided with the development of a large local increase in the total magnetic field. The author suggests that an east–west electric field associated with the asymmetric part (DS) of the ring current system was responsible for the vertical motion of the layer and hence for the large increases of n_t and N_mF2 seen in some storms a little before sunset. (auth) (UK)

1058 DIURNAL VARIATION IN THE MIDLATITUDE D REGION. Haug, A. (Auroral Observatory, Tromsoe, Norway); Thrane, E. V. J. Atmos. Terrest. Phys.; 32: 1641-7(Oct 1970).

The observed diurnal variation of electron density at a height of 77.5 km is examined in the light of two hypotheses for electron–ion recombination. In one of these $q \propto N^2$, where q is the electron production and N the electron density, in the other $q \propto N$. The latter assumption gives the better agreement between theory and experiment, when the electron production mechanism is ionization of nitric oxide by solar Lyman-α radiation, or ionization of O_2 ($^1\Delta g$) by solar ultraviolet. (auth) (UK)

1059 INVESTIGATION OF THE REFLECTION PROPERTIES OF VARIOUS IONOSPHERIC MODELS FOR RADIO WAVES IN THE FREQUENCY RANGE 16 TO 3000 kHz. Jones, T. B.; Wand, I. C. (Univ. of Leicester, Eng.). J. Atmos. Terrest. Phys.; 32: 1705-19(Oct 1970).

The reflection properties of typical D- and E-region models for radiowave frequencies varying from 16 kHz (vlf) to 3.0 MHz (hf) were calculated by full-wave, ray-tracing and phase-integral methods. The results of these calculations are compared with experimental observations of reflection coefficients in the frequency range 16 to 245 kHz, with oblique incidence absorption results (A3) at frequencies of 1178, 2614, and 2775 kHz and with vertical incidence measurements of absorption and equivalent height in the range 1.7 to 3.0 MHz. It was relatively easy to construct model ionospheres which yield calculated values of the propagation characteristics consistent with experimental results for any limited frequency range, but considerably more difficult to define profiles which account for measurements made throughout the frequency range from vlf to hf. Electron density distributions were established that yield calculated values in good agreement at all frequencies with the monthly median of the mid-day observations during summer and equinox sunspot minimum conditions. It proved extremely difficult to construct an

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average profile for the winter period due to the great variability of the experimental data during this season. (auth) (UK)

1060 ELECTRON DENSITY AND ELECTRON FLUX IN A GLOW AURORA. Bryant, D. A. (Radio and Space Research Station, Slough, Eng.); Courtier, G. M.; Skovli, G.; (and others). J. Atmos. Terrest. Phys.; 32: 1695-1704(Oct 1970).

Electron densities and electron intensities were measured from a Nike–Apache rocket, Ferdinand 14, launched into a glow aurora at Andøya in Northern Norway on March 3, 1967. The measurements give effective recombination coefficients α_{eff} for the altitude range 90 to 120 km that are consistent with current models of the lower E-region and rate coefficients measured in the laboratory. The mean value of α_{eff} is $(3 \pm 1.5) \times 10^{-7}$ cm^3 sec^{-1}. The proportion of the incoming electron energy converted into light is found to be $6 \times 10^{-3} \pm 2 \times 10^{-3}$ at OI (5577 Å) and $1.1 \times 10^{-3} \pm 0.4 \times 10^{-3}$ at N_2^+ (4278 Å). (auth) (UK)

1061 BEHAVIOR OF TOTAL ELECTRON CONTENT AND EQUIVALENT SLAB THICKNESS DURING MAGNETIC DISTURBANCES. Ma, Jih-chen (National Taiwan Univ., Taipei). J. Atmos. Terrest. Phys.; 32: 1687-93(Oct 1970).

The total electron content (TEC) and equivalent slab thickness data reduced from observations of 137-MHz transmissions from the geostationary satellite AT-3 at a sub-ionospheric point near 50°N and 68°W were statistically investigated. It was observed that: (a) a positive correlation exists between ΔTEC and $K_{p\,max}$ nearly all the time in winter; (b) the coefficient of correlation is, in general, positive, in the case of equivalent slab thickness during daytime, and negative after dark for all seasons changing from positive to negative during local sunrise; and (c) the decrease of TEC with increasing disturbance is usually accompanied by an increase of the equivalent slab thickness in daytime hours in equinox and summer, but not in winter. (auth) (UK)

1062 DAY-TO-DAY CHANGES IN THE F REGION IN SUMMER. Taylor, G. N. (Royal Radar Establishment, Malvern, Eng.); Earnshaw, R. D. S. J. Atmos. Terrest. Phys.; 32: 1675-85(Oct 1970).

Continuous Faraday rotation measurements of vhf signals from the synchronous satellite Early Bird were made from a Northern midlatitude station during two months in the summer of 1965. The experimental technique and method of calculating the total electron content (n_t) are described, and the main types of variation of n_t during the daytime are classified. Using a continuous 42-day time series of measurements, cross-correlation functions of several parameters with magnetic activity indices are calculated. A significant positive correlation at zero time shift is found between noon n_t and K_p; marginally significant positive correlations between n_t at 20 hr and K_p, between the time displacement from sunset of the diurnal peak in n_t and $\Sigma_{24} K_p$, and between noon slab thickness and K_p, are also found. The apparent linear loss coefficient at midnight shows no significant correlation either with K_p or with noon n_t on the following day. The integrated electron production rate at dawn shows some long term correlation with both the decimetric solar flux and the sunspot number. The correlation between noon n_t and K_p can be explained as a natural consequence of shifts in the time of occurrence of the evening peak on moderately disturbed days. This behavior is not observed in the maximum electron density, as it is probably masked by increases in slab thickness. Horizontal transport of plasma in the upper F region must be occurring; this could be driven either by the neutral air wind or by electric fields. (auth) (UK)

1063 EFFECT OF DIFFUSION PROCESSES ON THE HYDROGEN AND OXYGEN CONSTITUENTS IN THE MESOSPHERE AND LOWER THERMOSPHERE. Bowman, M. R.; Thomas, L.; Geisler, J. E. (Radio and Space Research Station, Slough, Eng.). J. Atmos. Terrest. Phys.; 32: 1661-74(Oct 1970).

The height distributions of the ten constituents $O(^3P)$, $O(^1D)$, O_2, O_3, OH, HO_2, H_2O, H_2O_2, H, and H_2 in the height range 60 to 120 km are obtained by solving the diffusion and continuity equations. Account is taken of both eddy and molecular diffusion, and use is made of recent revisions in rate-coefficient data. Particular attention is paid to constituents $O(^3P)$, O_3, OH, and H_2O. For these constituents, studies are made of the changes from the distributions corresponding to photochemical equilibrium, and the effects of changing the intensity of solar radiation and the water mixing ratio at 60 km. For O_3, $O(^3P)$, and H_2O the rates of the main production and loss reactions at different heights are also examined. (auth) (UK)

1064 TEMPORAL AND SPATIAL CHANGES OF THE ELECTRON CONTENT OF THE IONOSPHERE. Ebel, A. (Univ., Cologne). J. Atmos. Terrest. Phys.; 32: 1649-60(Oct 1970).

Measurements of the electron content of the ionosphere are analysed in order to study temporal and spatial variations of this parameter. Observations relating to a large part of a solar cycle are available for Australian and North American stations. Furthermore, measurements exist for a wide range of latitudes since October 1964 after the launching of Explorer 22. The analysis clearly shows the increase of the annual averages with solar activity and the decrease of the electron content with increasing geographic latitude. There is strong evidence for the existence of a semiannual variation of the electron content. Its amplitudes depend on solar activity and latitude similar to the mentioned annual averages. In general the variation is more marked in the afternoon and evening than in the morning of the days around the equinoxes. A semiannual variation is also known for the maximum electron density of the ionosphere and the temperature of the high atmosphere, and thus the same variation is expected for the equivalent slab thickness. But instead of the expected result there is only a semiannual variation of the daily change of this parameter. All these observed phenomena support the assumption that the semiannual variation in the studied ionospheric region is partly caused by plasma transport. (auth) (UK)

1065 E- AND E_s-LAYER DRIFTS OVER A LOW-LATITUDE STATION. Kaushika, N. D. (Univ. of Delhi). J. Atmos. Terrest. Phys.; 32: 1727-8(Oct 1970).

E- and sporadic E-layer drift motions obtained by the full correlation method are studied for a low-latitude station operative during IQSY. (auth) (UK)

1066 DOPPLER OBSERVATIONS OF IONOSPHERIC DISTURBANCES. Atkinson, P. A.; Edwards, S. J. (Leicester Polytechnic, Eng.). Contemp. Phys.; 11: 509-15(Sep 1970).

The Doppler shift in frequency of an ionospherically reflected radio wave can be used to study various ionospheric disturbances. The experimental arrangement for measuring such a shift is described, and examples of frequency shifts associated with solar flares, geomagnetic variations, and travelling disturbances are discussed. (auth) (UK)

1067 TANGENTIAL DRAG ON THE GEOMAGNETIC CAVITY. Coleman, Paul J. Jr. (McDonnell Douglas Astronautics Co., Santa Monica, Calif.). Cosmic Electrodyn.; 1: 145-59 (Sep 1970).

In most presently accepted models of the steady-state magnetopause some solar-wind plasma crosses the outer boundary of the geomagnetic cavity to form the Chapman–Ferraro boundary current. It is argued here that this plasma flows across the lines of magnetic force in the boundary layer and acts as a unipolar inductor by producing an electric field E in the direction opposite to that of $v \times B$. Thus, a tangential component of E appears on the inner surface of the boundary layer wherever there is a normal component of B. The background plasma in the geomagnetic cavity provides an electrically conducting path along the lines of magnetic force between the boundary layer and the ionosphere and the ionospheric plasma provides an electrically conducting path across the lines of magnetic force. Thus, electric current is driven by the boundary-layer flow. Because of this, current momentum and energy are transferred from the boundary-layer plasma to the ionospheric plasma, and there is a tangential drag on the geomagnetic cavity. The current is transverse to B in the boundary layer and in the ionosphere. It flows along B in the region between. This model accounts for the observed relationship between geomagnetic activity and atmospheric heating. In the steady state, the drag-induced current passes through the ionosphere where it drives the convection of the ionospheric plasma. Thus, energy taken from the solar-wind plasma in the drag region is dissipated by Joule and viscous heating in the ionosphere. The magnetic field produced by this current decreases the flux on the dayside of the cavity and increases it on the nightside, thus contributing flux to the geomagnetic tail. (auth)

1068 DUAL SATELLITE OBSERVATIONS OF EARTH'S BOW SHOCK. I. THE THICK PULSATION SHOCK. Greenstadt, E. W. (TRW Systems Group, Redondo Beach, Calif.); Green, I. M.; Inouye, G. T.; (and others). Cosmic Electrodyn.; 1: 160-77(Sep 1970).

A near conjunction of Vela 3A and Explorer 33, during which they were less than 7 R_E apart for 10 hours, occurred in and around the Earth's bow shock around 8:00 a.m. local time during quiet solar-wind conditions. The well-known distinction between sharp, relatively discontinuous shock jumps and more gradual, highly irregular pulsating-field shock profiles was observed by Explorer's plasma probe and magnetometer and Vela's magnetometer. For a 1-hour interval, both vehicles, 1.8 R_E radially apart in a conventional, rotationally symmetric shock reference frame, were simultaneously enclosed in a region of large shock-like magnetic pulsations where irregular, time-varying plasma

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distributions, neither solar wind nor magnetosheath, prevailed. A thickness for this shock pulsation region is estimated to be at least 1 and as much as 4 or more R_E based on the geometry of observation. At least at one point, Explorer was inside the magnetosheath's pulsation boundary while Vela, further downstream, was anomalously in the solar wind outside the boundary, implying an uneven outer envelope for the magnetosheath. Finally, upstream waves in the solar wind were correlated with shock pulsations: Whenever the shock was seen in pulsation form, waves were observed immediately outside it; whenever the shock was abrupt, upstream waves were absent. It is concluded that a pulsation form of shock with a distinct boundary profile, possibly always including upstream waves, commonly substitutes for the ordinary jump shock. (auth)

1069 RECONNECTION AND NOISE IN THE GEOMAGNETIC TAIL. Mihalov, J. D.; Sonett, C. P.; Colburn, D. S. (Ames Research Center, Moffett Field, Calif.). Cosmic Electrodyn.; 1: 178-204(Sep 1970).

Statistics of neutral sheet reconnection from the Ames magnetometer on Explorer 33 taken in 1966 are examined to reveal possible effects of sheet tipping. In particular, the effect on magnetic field components normal to the null sheet, caused by null sheet tipping due to solar-wind flow deviations or local tilting for other reasons, is specified analytically. Previous conclusions regarding southward magnetic fields are unchanged by modest (<30°) arbitrary tipping at individual sheet crossings. Additional data to January 1968 from both Explorer 33 and Explorer 35 reveal examples of significant, persistent southward fields normal to the sheet, in rotated coordinate systems with one axis formed by the direction of ΔB. Minimum variance determinations of null sheet orientations, and normal component signs and magnitudes are also given. Most but not all calculated normal components differ from zero by less than the combination of experimental and expected statistical uncertainties. Models of the distant (~60 R_E) neutral sheet with variations of the normal components that include occasional measurable northward and southward values are suggested. As a further topic, a model is introduced for the crossing times and locations for the clearest sheet crossings, mostly observed at distances of ~60 R_E, with 50- to 200-km sheet thicknesses (~10% of those reported at less than half this geocentric distance from Imp-1 data) and 0- to 10-km sec^{-1} speeds. This model is consistent with a thicker sheet on the dawn side. Also, an observed distribution of intervals between sheet crossings is presented. This distribution contains periods of ≲2 to 10 min reported from previous magnetic field and particle data from the geomagnetic tail. (auth)

1070 ROCKET EXPERIMENTS ON AURORAE: RESULTS OF EI 101 PROTON DETECTORS. Kirsch, E. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz, Ger.). Z. Geophys.; 36: 165-73(Apr 1970). (In German).

Scientific experiments of the first German Research Satellite were tested with Nike–Apache rockets at Fort Churchill, Canada (November 11, 1966) and at Kiruna, Sweden (December 5, 1967). The rockets were launched into a visible aurora. The results of the omnidirectional proton detector EI 101 are given. The normally expected galactic cosmic-ray intensity was measured at Kiruna. An additional radiation, which is interpreted as relativistic electrons (E > 3.2 MeV), was measured at Fort Churchill. The measured flux was 0.19 e^-/cm^2 sec ster ±25%. This result shows the sporadic precipitation of relativistic electrons from the outer radiation belt up to L values of 8.7. (tr-auth)

1071 METHOD FOR THE INTERPRETATION OF IONOSPHERIC ABSORPTION MEASUREMENTS DURING THE SUNRISE EFFECT IN THE D REGION. Cumme, G. (Observatory for Ionospheric Research, Kuehlungsborn, Ger.); Knuth, R.; Wagner, C.-U. Z. Geophys.; 36: 57-75(1970).

Results of A3 observations in the lf range at medium latitudes before and during sunrise are described. For absorption variation during nighttime and during sunrise at medium sunspot number, comparison is made between summer and winter. Generally, at constant R, the sunrise absorption increase is stronger in summer than in winter; it is very similar for propagation paths with different azimuths. At constant season, the sunrise absorption increase is stronger at R_{max} than R_{min}, indicating at least at medium latitudes nongalactic high-energy particles being the principal ionization source, if there are no solar cycle aeronomic changes. The classical O_2^--photodetachment model of the sunrise D region is checked by calculating the electron concentration profiles, which are needed to produce the observed summer sunrise absorption increase at medium sunspot number. The resulting theoretical electron concentration profiles, treated by full-wave calculation, give the observed absorption variation at negative sun heights below −4° (χ > 94°), but they do not agree with rocket measured electron concentrations nor with the strength of at least the galactic cosmic ray ionization rate. From the differences, an additional negative ion species, not affected by light penetrating the ozone layer, should be assumed especially in the 70- to 90-km height range. Further, an additional free electron source is indicated by the sunrise absorption increase at negative sun heights above −4° (χ < 94°), possibly negative ions the electrons from which are detached by photons not penetrating the ozone layer. Thus, for interpreting the sunrise behavior of the D region by electron detachment from negative ions, two ion species seem to be necessary: the first one being destroyed when visible light reaches the D region, and causing the η = −9° onset of sunrise effect in radio propagation whereas the electron from the second one is detached well above the ozone shadow. (auth)

1072 SOLAR WIND AND SEMI-ANNUAL VARIATION OF GEOMAGNETIC ACTIVITY. Siebert, M. (Univ., Goettingen, Ger.). Z. Geophys.; 36: 41-56(1970). (In German).

The monthly means of the linear activity measure Ap of the years 1932 to 1968 show that the semi-annual maxima of activity occur exactly at those times when the mean direction of the incident solar wind, as observed from the earth, is perpendicular to the rotational axis of the earth. The result is combined with the finding from the Mariner-2 measurements yielding a connection between Ap and the solar-wind velocity according to a power law. From the resulting mathematical expression the semi-annual variation, after reduction to average activity, can be explained quantitatively by the seasonal change in the geometric conditions of the solar-plasma flow against the earth's magnetic field. Thereby, the reduced amplitude of the semi-annual variation is determined by the exponent of the power law. Some problems are discussed concerning the other harmonics of the seasonal change of activity and the use of data due to shorter observation periods. (tr-auth)

1073 TIME VARIATION OF LOW-ENERGY PROTONS IN THE INNER RADIATION BELT. Achtermann, E.; Freden, S. C.; Hovestadt, D. (Max-Planck Inst. for Physics and Astrophysics, Garching, Ger.). Z. Geophys.; 36: 27-39(1970).

Measurements of protons in the inner radiation belt were performed with a French RUBIS rocket launched in April 1966 from Hamaguir (Algerian Sahara). With two solid-state-detector range telescopes and two solid-state-detector omnidirectional counters the proton energy ranges 1.3 to 13 MeV, 5.2 to 44 MeV, 2.7 to 4.5 MeV, 4.5 to 8.0 MeV, 8.0 to 12 MeV, 12 to 25 MeV (telescopes), and 6 to 20 MeV and 40 to 80 MeV (omnidirectional counters) were covered. Differential energy spectra were obtained in the region of B, L space from L = 1.46; B = 0.223 to L = 1.665; B = 0.168. The flux of protons for B, L values with a minimum altitude above 700 km agrees within a factor of less than 2 with previous measurements. With decreasing minimum altitude the measurements show a significantly lower flux of low-energy protons compared to previous data. Protons with energies above 20 MeV do not show a significant flux variation. (auth)

1074 ANALYTICAL–NUMERICAL APPROACH TO ANALYSIS OF IONOSPHERIC WAVE PROPAGATION. Raemer, Harold R.; Verma, Yash Pal (Northeastern Univ., Boston). Radio Sci.; 5: 1175-83(Aug-Sep 1970).

Difficulties were experienced with numerical integration approaches. The technique involves the modeling of the medium as a set of horizontal strata in which the ambient gas parameters are nearly constant, i.e., slowly varying. A perturbation theory allows the slow vertical variation to be taken into account in a purely analytical way that is based on a knowledge of the system-equation solutions for a homogeneous medium. The computer is used to find eigenvalues of the system matrix and to provide the numerical coefficients for the solution matrix, which is expressed analytically as a function of z, the vertical distance coordinate. Illustrative numerical results are presented that show eigenvalues (corresponding to modes of propagation) and certain elements of the solution matrix for a typical ionospheric parameter regime. (auth)

1075 VLF PHASE DISTURBANCES, HF ABSORPTION, AND SOLAR PROTONS IN THE PCA EVENTS OF 1967. Potemra, T. A.; Zmuda, A. J.; Shaw, B. W.; Haave, C. R. (Johns Hopkins Univ., Silver Spring, Md.). Radio Sci.; 5: 1137-45(Aug-Sep 1970).

The ionization model developed in conjunction with vlf and hf propagation parameters from analysis of the PCA's of August 28 and September 2, 1966, is applied in unmodified form to the 1967 events of January 28, February 2, May 23, and May 28. As for the 1966 events, proton intensities, energies, and cutoffs measured on the polar orbiting satellite 1963-38C are successfully connected to vlf phase disturbances and multifrequency riometer absorption increases. Considering all these events, the model pro-

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vides the following rms fits between observed and computed values: 4.0 μsec for 141 daytime and nighttime vlf phase values for seven paths at five frequencies during six proton events; 0.45 db for 181 riometer absorption values at 30 MHz during the six events; and 0.20 db for 36 riometer absorption values at 50 MHz during the two events that produced this absorption. The variability of the proton intensities and spectra provides a rigorous test of the validity and internal consistency of the ionospheric model deduced through the complementary use of riometer absorption and vlf propagation changes occurring during PCA's. The temporal variations in the proton cutoffs play an important role in the vlf analysis as a result of the lengths of the vlf transmission paths in relation to the polar-cap area disturbed by the solar protons. (auth)

1076 ELECTRON-DENSITY DISTRIBUTIONS IN THE LOWER IONOSPHERE WITH ASSOCIATED ERROR LIMITS DERIVED FROM VLF AND LF SOUNDER DATA. Shellman, C. H. (Naval Electronics Lab. Center, San Diego, Calif.). Radio Sci.; 5: 1127-35(Aug-Sep 1970).

A method is given for determining electron-density and collision-frequency distributions in the lower ionosphere from vlf and lf sounder data. Error limits are placed on the distributions by mapping the standard errors of the data into error limits on the ionospheric parameters. Interpretation of the error limits is discussed, especially in regard to the relationship between the resolution of a distribution and its error band. Examples are given that illustrate the method. (auth)

1077 SIMULTANEOUS OBSERVATIONS OF VARIOUS IONOSPHERIC PHENOMENA DURING THE GEOMAGNETIC STORM OF OCTOBER 31 TO NOVEMBER 2, 1968. Czechowsky, Peter; Kochan, Hermann; Lange-Hesse, Guenther; Lauche, Hans; Moeller, Hans Georg (Max-Planck Institut fuer Aeronomie, Lindau, Ger.). Z. Geophys.; 36: 77-103(1970). (In German).

At times of strong geomagnetic storms so-called radio aurorae appear as well as visual and subvisual aurorae especially in the polar ionosphere. These radio aurorae are caused by inhomogeneities of electron density that give rise to scattering of radio waves from the hf (3 to 30 MHz) to the uhf band (300 to 3000 MHz) in a very characteristic manner. During the magnetic storm from October 31 to November 2, 1968, it was possible for the first time to record backscatter echoes from radio aurora with a chain of transmitting and receiving stations that was completed in autumn 1967. The frequencies used were in the hf (3 to 30 MHz) and the vhf-band (30 to 300 MHz). Echoes from the E as well as from the F region of the ionosphere were received from the area between approximately 55 and 65° geomagnetic north. For the times when the most-southern transmitting and receiving line (Bielstein–Lindau) showed strong echoes, equivalent current systems were computed from the disturbance vectors of the magnetograms of ten geomagnetic observatories. The magnetic recordings and the backscatter amplitudes show very similar variations, sometimes even in detail. During the magnetic storm, the position of the polar electrojet (PEJ) changed continuously. The individual station received strong echoes at times when the PEJ lay in the area of the backscatter curve, which was computed for this station. The beginning and the end of the scattering process, as well as the amplitude of the scattered signals, also depend on the strength of the PEJ (threshold value). This confirms the theory of D. T. Farley and O. Buneman, that the electrojet produces the inhomogeneities of electron density (plasma waves) in the E region that give rise to scattering of radio waves. The echoes from field-aligned irregularities in the F layer are associated with high positive values of ΔH. The disappearance and the reappearance of the F2 layer of the ionosphere during this magnetic storm are observed by means of 2x F-scatter propagation. The backscatter measurements were complemented by optical observations as photometer recordings of the red (6300Å) and green (5577 Å) oxygen lines and by visual aurora observation from German ships. (tr-auth)

1078 DAYTIME IONOSPHERIC EFFECT ASSOCIATED WITH X-RAY FLARE FROM SCO XR-1. Ramanamurty, Y. V.; Mitra, A. P.; Jain, V. C. (National Physical Lab., New Delhi). J. Atmos. Terrest. Phys.; 32: 1721-6(Oct 1970).

The first evidence of a daytime ionospheric effect associated with an x-ray flare from the celestial x-ray source Scorpius XR-1 occurring on October 15, 1967 is presented. The effect is a decrease in the field strength of 164-kHz radio waves received at a great circle distance of about 1600 km from the sender. Ion production calculations for this event are given. (auth) (UK)

1079 CONTRIBUTION OF COSMIC RAYS TO IONOSPHERIC D-REGION IONIZATION. Tolmacheva, A. V. (Gorky State Univ.). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 830-6(1970). (In Russian).

The ionization in the lower D region, caused by the effect of galactic cosmic rays, is calculated, as well as the value of the absorption of radio waves propagating through this region. Results of calculations are compared with experimental data on the electron density in D region and with radio-wave absorption measurements. A conclusion is made that at the heights of 50 to 70 km the galactic cosmic rays constitute the main source of ionization both at temperate latitudes and auroral zones. The maximum of the electron density in the years of the minimum solar activity is about 10^2 cm^{-3}. The integral value of radio-wave absorption due to ionization of cosmic rays ranges 0.15 to 0.3 db at a frequency of 9 Mc. (tr-auth)

1080 CONVERSION OF WAVES IN A MAGNETOACTIVE PLASMA. Trakhtengerts, V. Yu. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 884-90(1970). (In Russian).

Some cases of decay interaction of waves in a homogeneous magnetoactive plasma, being of interest for ionospheric and magnetospheric investigations, are considered. The scattering and conversion of ulf radio waves are investigated in detail. A sharp rise of the conversion coefficient of longitudinal waves into electromagnetic waves near the ion gyrofrequency is discovered. The interaction between ordinary and extra-ordinary waves scattered on plasma density fluctuations are considered. (tr-auth)

1081 DETERMINATION OF THE ELECTRON DENSITY PROFILE IN THE D-REGION USING THE FREQUENCY DEPENDENCE OF ABSORPTION. Belikovich, V. V.; Itkina, M. A. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 873-83(1970). (In Russian).

A general solution is found for the integral equation relating the frequency dependence of absorption $\Gamma(\omega)$ and the profile N(h) in the kinetic theory approximation. The influence of random absorption measurement errors on the estimated N(h) profile is analyzed. It is stated that under the condition $\nu_{eff} = (^5/_2)\,\nu_m$, N(h) profiles, which were found using the formulas of elementary and kinetic theory, differ slightly. The method is shown to permit an estimation of only smooth N(h) profiles. Radio-astronomical methods in absorption measurements can be used to find N(h) profile only during ionospheric disturbances. (tr-auth)

Low-Temperature Physics and Cryogenic Equipment

Superfluidity

1082 PHENOMENOLOGICAL THEORY OF SOUND ATTENUATION NEAR THE λ POINT OF LIQUID HELIUM. Ueyama, Hiroshi (Osaka Univ.). Progr. Theor. Phys. (Kyoto); 44: 289-91(Jul 1970).

A tentative theory of the anomalous attenuation of the first sound near the λ-point of liquid He is given on the basis of the phenomenological theory of Pitaevskii and Usui. The experimental anomaly of the first sound above T_λ appears at higher temperatures than the thermal conductivity anomaly, suggesting a direct interference between the first sound mode and the order parameter relaxation. The dispersion equation for the first sound is derived, and Im $K^1(\omega, q) \sim \omega\epsilon^{-1}$; the exponent is too large (experimental value = 0.3 – 0.6), but an exponent of $-1/3$ can be obtained if $\alpha'\rho|\Psi|^2$ is dominant and the order-parameter makes underdamped oscillations owing to the inertial effect. (D.L.C.)

1083 SUPERFLUID CRITICAL-VELOCITY MEASUREMENTS UTILIZING PHASE COUPLING. Corke, H. E.; Hildebrandt, A. F. (Univ. of Houston, Tex.). Phys. Rev., A; 2: 1492-1501(1 Oct 1970).

Quantum-mechanical phase coherence in He II produces a coupling between elements of the superfluid that places restrictions upon the flow. This phase coupling was utilized in the flow of superfluid through wide (>10^{-3} cm) parallel channels to detect the first sign of flow impedance. A sensitive pressure-measuring device located in one of the channels was used to monitor the velocity and detect the superfluid critical velocity. Isothermal, as well as heat current flow, was investigated in the temperature range 1.71 to 2.15°K. The results substantiate the presence of phase coupling and indicate that a superfluid critical velocity exists, which agrees with the concept of vortex generation and is not influenced by normal fluid flow. Channel-size dependence was found to be approximately d^{-1} with only a small temperature dependence. At velocities well above critical, flow transitions were observed which indicated the onset of superfluid turbulence. The values of these turbulent critical velocities compare favorably with past data which give a channel-size dependence of $d^{-\frac{1}{2}}$. (auth)

1084 ANALOG OF THE AC JOSEPHSON EFFECT IN SUPERFLUID HELIUM. Richards, P. L. (Univ. of California, Berkeley). Phys. Rev., A; 2: 1532-41(1 Oct 1970).

When a chemical potential difference exists between the superfluid helium on two sides of an orifice, superfluid flow takes place at a critical velocity accompanied by the creation of quantized vortices. The frequency with which vortices are created is expected to be equal to the chemical potential difference (the analog of the ac Josephson frequency in superconducting tunneling). An experiment is described in which this frequency condition is verified by a method analogous to that used in superconductors. Experimental conditions were selected such that the gravitational head difference mgZ was the dominant contribution to the chemical potential difference. Z was measured by a capacitance technique. An ultrasonic transducer was used to modulate the flow through the orifice at the frequency ω so that the rate of creation of vortices was synchronized with the modulation frequency. The system was observed to exhibit dynamic stability at values of head difference $Z = n\hbar\omega/n'mg$ corresponding to n quantized vortices created every n' cycles of the modulation. The correspondence between theory and experiment is most convincing under experimental conditions such that the strength of the stability decreases rapidly with increasing values of the integer n'. This was found to occur with small orifices and with moderate modulation amplitude, in agreement with the results of the analogous experiments in superconductors. (auth)

1085 CONCERNING THE SECOND BRANCH OF THE SPECTRUM OF ELEMENTARY EXCITATIONS IN LIQUID ^{4}He. Pitaevskii, L. P. (Inst. of Physics Problems, Moscow). JETP Lett. (USSR) (Engl. Transl.); 12: 82-3(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 118-21(20 Jul 1970).

A second branch of elementary excitations in liquid helium is discussed from a theoretical point of view. The possible existence of a bound state with $\epsilon < 2\Delta$ is dealt with. Such a bound state should be manifest in the form of a pole in the vertex part for roton–roton scattering. The possibility of a third (also single-particle) branch lying above the two-particle branch is noted. (M.H.R.)

1086 ORDER-PARAMETER MAGNITUDE IN SUPERFLUID HELIUM. Puff, R. D. (Univ. of Maryland, College Park). Phys. Rev., A; 2: 1483-92(1 Oct 1970).

The time dependence of the order-parameter magnitude in superfluid helium is examined, and a simple conservation law is proposed for the hydrodynamic regime. The conservation law for the square of the order-parameter magnitude Ψ has the form $\partial\Psi/\partial t = -\vec{\nabla}\cdot[n_0\vec{v}_s + a_1(\vec{v}_n - \vec{v}_s) - a_2(\kappa/T\sigma)\vec{\nabla}T]$, where a_1 and a_2 depend on thermodynamic derivatives of the equilibrium condensate density n_0. It is found that Ψ cannot be determined entirely from the local temperature and pressure except for infinitely slow disturbances, and the latter condition of "static local equilibrium" is used to develop the conservation law. Specifically, the existence of some conservation law $\dot{\Psi} = -\vec{\nabla}\cdot\vec{\Lambda}$ together with static local equilibrium and a hydrodynamic structure for the current $\vec{\Lambda}$, are necessary assumptions in this development. (auth)

1087 ION-MOBILITY DISCONTINUITIES IN He II. Steingart, Marvin; Glaberson, William I. (Rutgers Univ., New Brunswick, N. J.). Phys. Rev., A; 2: 1480-2(1 Oct 1970).

Results are reported of experiments performed attempting to observe the periodic ion-mobility discontinuities in He II reported by Careri et al. and others. Using a less ambiguous technique, results are obtained that indicate the absence of these discontinuities over the temperature range of the original experiments. Schwarz reported results similar to these at a single temperature. (auth)

1088 PEAK HEAT FLUX DENSITY OF SUPERFLUID He II IN INSULATED VERTICAL CHANNELS WITH CLOSED ENDS AND WELLS. Chapman, R. C.; Chang, Y. W.; Frederking, T. H. K. (Univ. of California, Los Angeles). Advan. Cryog. Eng.; 15: 290-8(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The theoretical constraints, in particular transport limits of the superfluid near the lambda point, and thermally induced turbulence in the quantum liquid He II are considered. (M.H.R.)

1089 APPLICATIONS OF HELIUM TO VERY-LOW-TEMPERATURE REFRIGERATION. Wheatley, J. C. (Univ. of California, San Diego, La Jolla). Contract AT(11-1)-34. Advan. Cryog. Eng.; 15: 415-21(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The dilution refrigerator and compressional cooling are discussed. The properties of helium necessary to understand the principles of operation of these devices are reviewed and the main features of the devices are described. (M.H.R.)

1090 CALCULATION OF COLLISIONLESS SOUND VELOCITY IN SUPERFLUID HELIUM. Enz, Charles P. (Univ., Geneva). J. Low Temp. Phys.; 3: 1-22(Jul 1970).

The contribution of the leading self-energy diagrams are calculated with particular attention to the possible effect on sound propagation of the collective phonon mode, through vertex renormalization. It is emphasized that the correct complex-frequency renormalization is related, by a Dyson equation, to the Fourier-transformed density autocorrelation function D. A numerical analysis of velocity data contained in an earlier publication is carried further, and the singularity structure of the Green's function D is shown to contain features in addition to the sound pole. (auth)

1091 CALORIMETRIC EVIDENCE FOR POSITIVE PHONON DISPERSION IN LIQUID ^{4}He. Phillips, Norman E.; Waterfield, C. G.; Hoffer, J. K. (Univ. of California, Berkeley). Phys. Rev. Lett.; 25: 1260-2(2 Nov 1970).

The constant-volume heat capacity of liquid ^{4}He was measured from 0.3°K to above the λ point. Below 0.9°K, the phonon heat capacity corresponds to a dispersion relation $\epsilon = cp(1 - \gamma p^2)$ with γ varying from -4.1×10^{37} g^{-2} cm^{-2} sec^2 at the saturated vapor pressure to 19.6×10^{37} g^{-2} cm^{-2} sec^2 near the freezing pressure. (auth)

1092 NOTE ON A SIMPLE METHOD FOR DETERMINING THE ISOTOPIC CONCENTRATION OF A ^{3}He–^{4}He GAS. Kagiwada, R. S. (Univ. of Southern California, Los Angeles); Rudnick, I. J. Low Temp. Phys.; 3: 113-14(Jul 1970).

A measurement of the sound velocity in a pure ^{3}He–^{4}He gas at low pressure may be used to determine the isotopic concentration. If the velocity U_4 in pure ^{4}He gas is known, the isotopic fraction x (^{3}He/total He) is given by $x = (1 - U_4^2/U^2)/(1 - m_3/m_4)$. Corrections for dense gases and for the "heat flush" effect above liquids are pointed out. (D.L.C.)

Superconductivity

Refer also to abstract 469.

1093 (CALT-822-13) SUPERCONDUCTIVITY IN THE PSEUDOBINARY ALLOYS V_3Si–Nb_4Al. Newkirk, L. R.; Tsuei, C. C. (California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials). Oct 1970. Contract AT(04-3)-822. 8p. Dep. NTIS.

The compounds Nb_4Al and V_3Si were found to be mutually soluble. The superconducting transition temperature and the lattice spacings were measured over the entire range of the pseudobinary system. The lattice parameter varied smoothly with composition, and the variation of the superconducting transition temperature exhibited a deep minimum centered near the middle of the pseudobinary. This behavior was interpreted in terms of phonon propagation along the face-centered chains of atoms in the A15 structure, and the effect of foreign atoms on this propagation. (auth)

1094 (NYO-3029-45) FLUCTUATIONS NEAR THE PHASE TRANSITION IN "ONE-DIMENSIONAL" SUPERCONDUCTORS. Warburton, R. J.; Webb, W. W. (Cornell Univ., Ithaca, N. Y. Dept. of Applied Physics). 21 Sep 1970. 31p. (CONF-700918-1). Dep. NTIS.

From Battelle Conference on Critical Phenomena, Geneva, Switzerland.

The effects of thermodynamic fluctuations on the superconducting order parameter can be observed readily near the critical temperature if the fluctuation volume is restricted by reducing the physical dimensions of the system. A comparison is made between several competing theories that predict the effect of fluctuations on the temperature dependence of the electrical resistivity near the transition temperature. Measurements of the complete resistive transition of "one-dimensional" single crystals of tin were extended through the critical region down to 10^{-5} ohms and the current–voltage characteristics were extended to a sensitivity of 10^{-15} volts in order to thoroughly test these theories. (auth)

1095 (UCRL-19653) MICROWAVE PHOTON ASSISTED TUNNELING IN SUPERCONDUCTING TUNNEL JUNCTIONS. Sweet, James Newton (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 116p. Dep. CFSTI.

An experimental study has been conducted on microwave photon-

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assisted tunneling in superconducting Sn/I/Sn and Sn/I/Pb tunnel junctions. The junctions were situated in a perpendicular rf electric field with the microwave voltage and frequency satisfying the condition, $eV_{rf}/\hbar\omega \leq 60$. For quasi-particle tunneling, excellent agreement with the power dependence predicted by the theory of Tien and Gordon has been obtained for junctions with large normal-state resistances. The response of low-resistance junctions has been found to agree well with the predictions of a phenomenological lumped-circuit junction model, which includes the effects of junction capacitance. The effective rf voltage seen by the quasi-particle current is, however, an order of magnitude greater than that which is estimated to be present from rf power measurements. The interaction of microwaves with Josephson currents was studied for the same junctions and the response compared to the theoretical predictions of Werthamer. In this case, quantitative agreement with the theory is generally poor and does not appear to be correlated with sample resistance. In particular, the quasi-particle and Josephson currents do not see the same value of microwave voltage at the fundamental frequency ω. (auth)

1096 (UCRL-Trans-1413) SUPERCONDUCTIVITY OF QUENCHED CONDENSED Pb-Bi ALLOYS. Hasse, J.; Seiberth, J. Translated for Univ. of California Lawrence Radiation Lab., Berkeley, from Z. Phys.; 213: 79-88(1968). 18p. Dep. NTIS.

An abstract of this paper, prepared from the original language, appeared as NSA 22: 34559.

1097 (UCRL-Trans-1418) SPIN ORDERING PARAMAGNETIC ADDITIONS TO SUPERCONDUCTING FILMS PREPARED BY QUENCHING CONDENSATION. Korn, Dietrich. Translated for Univ. of California, Lawrence Radiation Lab., Berkeley, from Z. Phys.; 187: 463-77(1965). 10p. Dep. NTIS.

An abstract of this paper, prepared from the original language, appeared as NSA 20: 2918.

1098 ELECTRONIC STATES NEAR SUPERCONDUCTIVE TRANSITION TEMPERATURE. Takada, Satoshi (Tokyo Univ. of Education). Progr. Theor. Phys. (Kyoto); 44: 298-300(Jul 1970).

The effects of fluctuations of a pure superconductor on the electronic states above the transition temperature are investigated without using the mean field theory. A two-component system consisting of quasiparticles and fluctuations is considered, and one- and two-particle Green's functions are derived. Equations are derived for the spectral density and electronic density of states $n(\omega)$. The density of states at the Fermi level [n(0)] is perfectly depressed; there is a kink at $\omega = 0.97s$, and the derivative with regard to ω diverges logarithmically at $\omega = s$. These features are consistent with the tunneling experiments of Cohen, Abeles, and Fuselier. The behavior of s near the transition point is considered; if the vertex connecting four Green's functions describing the propagation of Cooper pairs remains finite at T_c, $S^2 \propto \epsilon^7$ and hence converges at $T = T_c$. In such a case, the electronic density of states $n(\omega)$ rises more sharply as $T \rightarrow T_c$. (D.L.C.)

1099 SUPERCONDUCTIVE ZITTERBEWEGUNG. Lurie, D.; Cremer, S. (Technion-Israel Inst. of Tech., Haifa). Progr. Theor. Phys. (Kyoto); 44: 300-2(Jul 1970).

A relativistic particle undergoes a trembling motion (Zitterbewegung) over a distance of the order of its Compton wavelength. An analogous effect in superconductivity is pointed out; a Bogolyubov quasi particle is shown to undergo Zitterbewegung over a distance of the order of the Pippard coherence length $\xi_0 = v_f/\pi\Delta$ with a frequency of the order of twice the energy gap. This Zitterbewegung effect is shown to be due to the close similarity of the quasi-particle wave equation to the equations of relativistic quantum mechanics. (D.L.C.)

1100 OBSERVATION OF "ANDREEV" REFLECTION OF ELECTRONS FROM THE BOUNDARY BETWEEN A NORMAL AND SUPERCONDUCTING PHASE, USING THE RADIO-FREQUENCY SIZE EFFECT. Krylov, I. P.; Sharvin, Yu. V. (Inst. of Physics Problems, Moscow). JEPT Lett. (USSR) (Engl. Transl.); 12: 71-3(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 102-5 (20 Jul 1970).

It is shown that a more direct observation of the phenomenon of electron reflection from the normal-superconducting (n-s) boundary than was previously made is possible. In measurements of the surface impedance of an n-layer that borders on one side with vacuum and on the other side with the s-phase, in the case when the electrons have a large mean free path, the reflection of the electrons from the n-s boundary and their return to the skin layer should exert an influence on the value of the surface impedance and lead to the occurrence of a radio-frequency size effect of a new type. The results are shown graphically. The close agreement between the experimental line positions and the calculated ones confirms the reflection law proposed by Andreev. (M.H.R.)

1101 CRYSTAL STRUCTURE AND SUPERCONDUCTING PROPERTIES OF TANTALUM NITRIDE OBTAINED AT HIGH PRESSURES. Boiko, L. G.; Popova, S. V. (Inst. of High Pressure Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 12: 70-1(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 101-2(20 Jul 1970).

The possibility of crystallizing tantalum nitride in a structure of NaCl type at high pressure and temperatures was investigated. The initial product employed was tantalum nitride of stoichiometric composition, which crystallizes in a structure of the CoSn type. Measurement of the critical temperature of the obtained samples was performed by a magnetic method down to 4.2°K. The phase with the NaCl structure has an average critical temperature of transition into the superconducting state of 6.5°K, and for most samples the width of the transition is about 1°K. The phase with the WC structure has no superconducting transition down to 4.2°K. No superconducting transition was observed in Ta_2N down to this temperature. (M.H.R.)

1102 ULTRASONIC INVESTIGATION OF THE ELECTRON-PHONON INTERACTION IN SUPERCONDUCTING HIGH-PURITY RHENIUM. Robinson, D. A.; Levy, M. (Univ. of California, Los Angeles). Solid State Commun.; 8: 1443-6(15 Sep 1970).

The attenuation of transverse ultrasonic waves propagating along the c-axis in high purity rhenium was measured in the normal and superconducting states. A high-temperature superconducting gap parameter or 3.80 ± 0.20 was found, and the sharp drop in attenuation at T_c was investigated. (auth) (UK)

1103 MAGNETIZATION MEASUREMENTS ON TWISTED SUPERCONDUCTING COMPOSITE CONDUCTORS. Critchlow, P. R.; Zeitlin, B. (Air Reduction Co., Inc., Murray Hill, N. J.). J. Appl. Phys.; 41: 4860-5(Nov 1970).

Magnetization measurements are reported on twisted multistrand NbTi superconducting composites. Data for copper matrix composites when fitted to the theoretical predictions give reasonable values for the matrix resistivity. Data for a CuNi matrix composite and data on the rate of decay of the magnetization at small twist rates do not agree with simple theory. An explanation based on the presence of an untwisted core removes the disagreement. Finally, the data are plotted to show a linear dependence of magnetization on filament diameter over the range 0.00036 to 0.015 in. (auth)

1104 SUPERCONDUCTIVITY AND DIELECTRIC CONSTANT OF HIGHLY CONDUCTIVE COMPLEXES OF TETRACYANO-QUINODIMETHANE (TCQM). Buravov, L. I.; Khidekel, M. L.; Shchegolev, I. F.; Yagubskii, E. B. JETP Lett. (USSR) (Engl. Transl.); 12: 99-100(5 Aug 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 142-4(5 Aug 1970).

The temperature dependence of the electric conductivity and dielectric constant of single crystals of TCQM complexes of acridine (I) and N-methylphenazine (II) at 10^{10} Hz was measured at 4.2 to 300°K. The microwave conductivity coincides with the dc conductivity at the higher temperatures, but below 77°K, the microwave conductivity decreases much more slowly than the dc conductivity. The dielectric constant ϵ' is anomalously large at 4.2°K, ~800 for I and ~350 for II. The results indicate that the system contains some inhomogeneities that inhibit the motion of the electrons, and that the complexes tend more to become superdielectrics than superconductors. (D.L.C.)

1105 EFFECTS OF OSCILLATORY MAGNETIC FIELDS ON THE FLUX FLOW PROPERTIES OF SUPERCONDUCTING FOILS. Joiner, W. C. H.; Ohmer, Melvin C. (Univ. of Cincinnati). Solid State Commun.; 8: 1569-71(1 Oct 1970).

The effects of a superimposed oscillatory magnetic field on the flux flow properties of a superconducting foil are studied. It appears that although the oscillatory field depins fluxoids, the flux flow resistivity attains a unique value only when all fluxoids participate in the flux flow. Thus when this criterion is satisfied, the resistivity is independent of whether an oscillatory depinning field is used. (auth) (UK)

1106 SUPERCONDUCTING BEHAVIOR OF THE SYSTEM $Pb(Nb_{1-x}Ta_x)S_2$. Schmidt, L. (Univ. of California, San Diego, La Jolla); McCarthy, S. L.; Maita, J. P. Solid State Commun.; 8: 1513-15(1 Oct 1970).

Superconducting transition temperatures in the pseudo-binary system $Pb(Nb_{1-x}Ta_x)S_2$ depend on composition and thermal treatment of the samples. After annealing at relatively low temperatures, a transition minimum is observed for a composition with

$x \approx 0.33$. The variation of the transition temperature is discussed with respect to results of specific heat measurements. (auth) (UK)

1107 DISPERSION LAW FOR OPTICAL PHONONS AND PLASMONS IN A SUPERCONDUCTOR. Demikhovskii, V. Ya.; Shmatkova, N. I. (Gorky State Univ., USSR). Sov. Phys.-Solid State (Engl. Transl.); 12: 844-8(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1080-5(Apr 1970).

A study is made of the dispersion law for longitudinal and transverse optical phonons and plasmons in superconductors. As a result of the dispersion relations, the most pronounced changes in the spectrum occur at frequencies $\omega = 2\Delta$, where Δ is the energy gap. In superconducting semiconductors and in high-temperature superconductors such as β tungsten, for which the ratios $\tilde{\omega}_{op}/2\Delta$ and $\tilde{\omega}_{pl}/2\Delta$ may be of the order of unity, the superconducting transition leads to characteristic changes in the spectra of optical phonons and plasmons (ω_{op} and ω_{pl} are the renormalized frequencies of the optical phonons and plasmons, respectively). Calculations are made of the corrections to the spectra of optical vibrations in polar and nonpolar crystals and also to the spectrum of plasma oscillations associated with the rearrangement of the electron spectrum at the superconducting transition. It is shown that, in contrast to a normal metal, the damping of plasmons and optical phonons in a superconductor does not vanish at small values of k, even at $T = 0$. At the same time, the damping tends to infinity as $\omega \to 2\Delta$. (auth)

1108 SUPERCONDUCTIVITY OF THALLIUM AT HIGH PRESSURES. Il'ina, M. A.; Itskevich, E. S. (Inst. of High-Pressure Physics, Akademgorodok, USSR). Sov. Phys.-Solid State (Engl. Transl.); 12: 965-7(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1240-3(Apr 1970).

The phase diagram of thallium in the temperature range 77 to 350°K is described. The temperature T_c at which the transition to the superconducting state occurs is investigated for two crystalline modifications of thallium, Tl II and Tl III, as a function of pressure in the range 30 to 60 kbar. For Tl III, the quantity $dT_c/dp = -(2.0 \pm 0.4) \times 10^{-5}$ deg/bar and the transition temperature extrapolated to zero pressure $T_c(p=0) = (3.0 \pm 0.2)$ °K. For Tl II, the quantity $dT_c/dp = -(1.0 \pm 0.1) \times 10^{-5}$ deg/bar in the linear region. The results for Tl III are at variance with a previous study. Reasons for the discrepancy are discussed. (auth)

1109 SUPERCONDUCTIVITY AND ITS APPLICATIONS. Williams, J. E. C. London; Pion Ltd. (1970). 213p. 46s.

The subject is covered under the following headings: a survey of superconductivity; the history of superconductivity; the superconducting energy gap; the occurrence of superconductivity; the thermodynamics of Type-I superconductors; quantum effects; the theory of Type-II superconductors; hard superconductors; superconducting magnets; superconductive ac power devices; aggregation of flux in superconductors; quantum devices; Josephson junctions; the application of superconductivity to computers; the application of superconductivity to electronics; and high-frequency applications of superconductors. (UK)

1110 EFFECTS OF TRAPPED FLUX ON ac-LOSS MEASUREMENTS IN SUPERCONDUCTORS. Male, J. C. (Central Electricity Research Labs., Leatherhead, Eng.). Cryogenics; 10: 381-5(Oct 1970).

Ac loss measurements were made, by an electrical method, on superconducting niobium samples in the form of tubes and foils. The measured losses can depend strongly on the magnetic history of the samples and characteristic flux motion waveforms are observed when losses are enhanced by the presence of trapped flux. (auth) (UK)

1111 FLUX JUMP BEHAVIOR OF SINTERED Nb_3Sn CYLINDERS. Maier, R. G. (Siemens AG, Munich). Solid State Commun.; 8: 1473-5(15 Sep 1970). (In German).

It can be shown by measuring the shielding properties of superconducting hollow Nb_3Sn cylinders that the stability against flux jumps decreases with increasing diameter of the cylinder. (auth) (UK)

1112 SUPERCONDUCTING ROTATION ELLIPSOID IN AN UNIFORM MAGNETIC FIELD. Kayander, O. D. Izv. Vyssh. Ucheb. Zaved., Elektromekh.; 13: No. 1, 8-11(1970). (In Russian).

Alternating magnetic field perturbations by a superconducting rotating ellipsoid, with geometric dimensions shorter than the length of the external field were studied. Data obtained for the boundary conditions were used for resolving formulas for field perturbations in any arbitrary space points, including the surface of the ellipsoid. Calculations were made for the ellipsoid in a homogeneous magnetic field, with the external field both perpendicular and parallel to the axis of rotation. (R.V.J.)

1113 TWO-BAND MODEL IN FLUX FLOW OF TYPE-II SUPERCONDUCTORS. Ho, Lai-chak (Univ. of Toronto). Can. J. Phys.; 48: 1939-40(1 Sep 1970).

A two-band model for the flux-flow resistivity and the Hall angle of type-II superconductors in low magnetic field regions is studied using the Bardeen–Stephen theory. The original theory considers free electrons only in the normal cores of the vortices. Results are obtained that qualitatively explain some experimental data. (auth) (Canada)

1114 ATTRACTIVE ELECTRON–ELECTRON INTERACTION INDUCED BY THE DYNAMICAL JAHN–TELLER EFFECT INVOLVING DEGENERATE IMPURITY ORBITALS: A THEORY OF THE IMPURITY ENHANCEMENT OF THE SUPERCONDUCTIVE TRANSITION TEMPERATURE IN DILUTE ALLOYS. Kumar, N. (Univ. of British Columbia, Vancouver). Phys. Rev., B; 2: 2500-11(1 Oct 1970).

The dynamical Jahn–Teller effect associated with a 3d transition-metal impurity atom substituted in a simple metal is examined theoretically. The impurity atom is assumed to carry an essentially twofold-degenerate partially filled E_g-type electronic level lying close to the Fermi surface of the host metal. These degenerate impurity orbitals are shown to couple dynamically to the lattice through the Jahn–Teller effect. This latter coupling is "seen" by the conduction electrons via the resonant "s–d" interaction. The resulting indirect conduction-electron–phonon coupling gives rise to an additional pairing interaction in the second order and involves the impurity orbitals dynamically. Under certain conditions of the impurity-level broadening (Δ) and positioning (δ) relative to the Fermi level, the above mechanism leads to a BCS-type attractive interaction parameter V_{e-e} given by $V_{e-e} \cong c_i[\Delta^2/(\Delta^2+\delta^2)^2]\,[E_{J-T}/2\pi^2\rho(\epsilon_F)^2]$, where c_i is the fractional concentration of the impurity centers, $\rho(\epsilon_F)$ is the density of states at the Fermi level, and E_{JT} is the Jahn–Teller stabilization energy. The parameter V_{e-e} was estimated numerically for the Al:Fe system and found to be in reasonable agreement with the experimental values reported in the literature. It appears that the anomalously large impurity enhancement of the superconductive transition temperature observed in certain dilute alloys, such as Fe dissolved in Ti, Zr, and Al up to 1 at.%, may find a semiquantitative explanation in terms of the present mechanism. In deriving the above expression, the approximate procedure of unitary transformation was made use of. All renormalization effects were neglected. Also, the quasi-molecular approximation was used in treating the Jahn–Teller effect of the impurity center. The many-impurity effect was treated in the spatial random-phase approximation. Certain group-theoretical arguments were employed to arrive at the mixing matrix elements involved in the determination of the width parameter Δ, appropriate to the present mechanism. The actual calculations were carried out for the case of a simple-cubic host lattice. However, the treatment holds for all centrosymmetric cubic lattices, the differences showing up only in the form of certain multiplicative form factors. (auth)

1115 THEORY OF ELECTRON SPIN RESONANCE IN TYPE-I SUPERCONDUCTORS. Aoi, Koya; Swihart, James C. (Indiana Univ., Bloomington). Phys. Rev., B; 2: 2555-60(1 Oct 1970).

In order to determine whether electron spin resonance in type-I superconductors is experimentally possible, Dyson's theory was extended to the case of a superconductor, taking into account the penetration depth of electromagnetic fields, the change in phase of the surface impedance, and the change in group velocity and relaxation time of the quasi particles compared to the normal case. Line shapes and magnitudes of power absorbed and rf field transmitted for various frequencies and temperatures for thin-film superconductors were calculated. From the calculation, the optimum temperatures and frequencies were determined and it was concluded that, even for these conditions, the experiment would be difficult. (auth)

1116 BREAKDOWN OF THE MEAN FIELD THEORY IN THE SUPERCONDUCTING TRANSITION REGION. Hurault, J. P.; Maki, K. (Faculte des Sciences, Orsay, France). Phys. Rev., B; 2: 2560-9(1 Oct 1970).

A dirty superconducting material above its transition temperature is considered. Using a perturbation expansion, the effect of the fluctuations of the order parameter on the electron Green's function G as well as on the fluctuation Green's function D is studied. The main results are: (a) G and D can be determined separately. (b) The behavior of D can be analyzed using the Ginzburg–Landau functional where the only nonlinear term present is the lowest-order one. (c) As a result of this analysis, the corrections to the mean field theory are generally small as far as D is concerned. They become important only at the onset of

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the critical region, where the perturbation approach breaks down. A criterion for the onset of this critical region is derived and the estimate is compared to previous ones. (d) On the other hand, G is well described by taking only the lowest-order correction to the electron self-energy due to the fluctuations, even inside the critical region. (e) A scheme for the analysis of the critical region is proposed. (f) In this way the complete equivalence between the critical behavior of the interacting Bose system and that of a superconductor is established. (auth)

1117 LATTICE VIBRATIONS AND SUPERCONDUCTIVITY IN LAYERED STRUCTURES. Allen, R. E.; Alldredge, G. P.; de Wette, F. W. (Univ. of Texas, Austin). Phys. Rev., B; 2: 2570-3(1 Oct 1970).

In order to estimate the influence of both surface and interface effects on phonon frequencies and superconducting transition temperatures in layered structures, the vibrational modes of structures composed of alternating films of heavy and light particles were calculated. An interface effectively lowers the vibrational frequencies of the heavy particles and raises those of the light particles. Interface effects are small compared to surface effects, however. The decrease in the frequencies for a three-layer film on a substrate (with respect to the bulk frequencies) is only 40 to 50% of the decrease for a free three-layer film. (auth)

1118 NONLINEAR RESPONSES IN TYPE-II SUPERCONDUCTORS. I. DIRTY LIMIT. Maki, Kazumi (Univ. of California, San Diego, La Jolla. Faculte des Sciences, Orsay, France). Phys. Rev., B; 2: 2574-80(1 Oct 1970).

A theoretical study is made of nonlinear responses of a dirty type-II superconductor to microwaves. The generation of a large third-harmonic current is found, arising from the nonlinearity of the dynamics governing the motion of the order parameter in the vortex state. Furthermore, the harmonic currents reveal interesting anisotropy, viz., a dependence on the angle between the direction of the microwave current and that of the dc magnetic field. (auth)

1119 TEMPERATURE AND FREQUENCY DEPENDENCE OF THE SURFACE RESISTANCE IN THE VORTEX STATE OF TYPE-II SUPERCONDUCTORS. Fischer, Gaston (Univ. of Montreal); McConnell, R. D.; Monceau, P.; Maki, Kazumi. Phys. Rev., B; 2: 2817-18(1 Oct 1970).

The temperature and frequency dependence of surface-resistance data obtained in the vortex state of superconducting Pb–In alloys are analyzed. Measurements near H_{c2} indicate the normalized slope $s_2^+ = (H_{c2}/R_n)\partial R/\partial H|_{H_{c2}}$ tends to go to zero as the critical temperature is approached. The data are accounted for qualitatively if the frequency dependence of the flux-flow conductivity (dynamical fluctuations) is retained in the expression for the microwave current. There is no exact quantitative agreement, and the possibility of a strong-coupling correction is suggested. (auth)

1120 EFFECT OF THERMAL NOISE ON THE dc JOSEPHSON EFFECT. Biswas, A. C.; Jha, Sudhanshu S. (Tata Inst. of Fundamental Research, Bombay). Phys. Rev., B; 2: 2543-7 (1 Oct 1970).

An approximate analytic solution of the Fokker–Planck equation describing the effect of thermal fluctuations on the dc Josephson voltage, which is valid for finite capacitance of the junction, is obtained. It is shown that the solution should be applicable in the important region of experimental interest. (auth)

1121 ANOMALOUS BEHAVIOR OF H_{c3}/H_{c2} NEAR T_c FOR Sn–In AND In–Bi ALLOY SYSTEMS. Maloney, M. David; de la Cruz, Francisco; Cardona, Manuel (Brown Univ., Providence). Phys. Rev., B; 2: 2512-19(1 Oct 1970).

Previously reported measurements of the ratio H_{c3}/H_{c2} for tin-rich Sn–In alloys and indium-rich In–Bi alloys were extended in further detail, and include variations in foil thickness (6 to 300 μ). The anomalous behavior in the ratio very near T_c is found to be dependent on foil thickness. Each alloy system is characterized by a certain thickness, above which H_{c3}/H_{c2} decreases markedly as T_c is approached, and below which the opposite behavior takes place. The results can be interpreted qualitatively in terms of a sandwich model in which the strength of the pairing interaction is depressed in a layer at the surface of the sample. For the thickest samples (most nearly "semi-infinite"), there is good quantitative agreement with the recent theory of this proximity effect given by Fink and Presson. (auth)

1122 SUPERCONDUCTING PENETRATION DEPTH OF LEAD. Gasparovic, R. F.; McLean, W. L. (Rutgers–The State Univ., New Brunswick, N. J.). Phys. Rev., B; 2: 2519-26(1 Oct 1970).

The temperature dependence of the change in the superconducting penetration depth λ from its value at absolute zero was measured in polycrystalline and single-crystal specimens of lead, using radio-frequency fields at about 80 MHz. In the polycrystalline material, it was found that the temperature dependence is the same as that of a weak-coupling superconductor with Δ_T/Δ_0 given by the BCS theory and with an energy gap $2\Delta_0 = 3.75kT_c$, rather than $2\Delta_0 = 4.3kT_c$, the value found from tunneling measurements. Near the transition temperature T_c, $d\lambda/dy = 418 \pm 9$ Å, where $y = (1-t^4)^{-\frac{1}{2}}$ and $t = T/T_c$. A full comparison with Nam's general formulation of the electromagnetic properties of superconductors (which encompasses strong coupling effects) awaits more detailed theoretical work on lead. Among the single crystals, there is a small anisotropy in the values of $d\lambda/dy$ near T_c, and at lower temperatures a slight anisotropy in the form of the temperature dependence of λ. A review of all the relevant experiments on lead gives the following consistent values for the coherence length and London penetration depth of lead: $\xi_0 = 960$ Å, $\lambda_L(0) = 305$ Å. (auth)

1123 SUPERCONDUCTIVITY OF DILUTE INDIUM–THALLIUM ALLOYS. Gubser, D. U.; Mapother, D. E.; Connelly, D. L. (Univ. of Illinois, Urbana). Phys. Rev., B; 2: 2547-55(1 Oct 1970).

Critical-field measurements, determined from isothermal magnetization curves, are reported for InTl alloys covering the concentration range of 0 to 7% Tl. Since In and Tl have the same number of valence electrons, the valence effects which tend to mask the effect of anisotropy in the energy gap should be minimized. Critical-field measurements down to T = 0.35°K provide an accurate determination of H_0, the critical field at T = 0, and of γ, the temperature coefficient of the normal electronic specific heat. New values for γ (=1.672 ± 0.003 mJ/mole °K) and for H_0 (=281.53 ± 0.06 G) are reported for pure In. No effect on γ due to alloying is observed; however, changes in the quantities T_c, H_0/T_c, and $(dH_c/dT)_{T=T_c}$ are observed and are compared with the anisotropy theory of Markowitz and Kadanoff and of Clem. Significant departures from the predictions of anisotropy theory are noted for all the measured parameters. (auth)

1124 ULTRASONIC ATTENUATION OF LONGITUDINAL WAVES IN PURE SUPERCONDUCTING NIOBIUM IN HIGH MAGNETIC FIELDS. Tang, I-ming (Reed Coll., Portland, Oreg.). Phys. Rev., B; 2: 2581-6(1 Oct 1970).

By adapting the approach of Kadanoff and Falko to the two-band model, the ultrasonic attenuation coefficient for longitudinal waves in two-band superconductors is obtained. The attenuation coefficient is expressed in terms of various correlation functions. Using the techniques developed by Maki for evaluating the various correlation functions for pure superconductors in high fields, the longitudinal attenuation for arbitrary ql is obtained for the case in which the propagation vector of the sound wave is parallel to the magnetic field. The $(H_{c2}-H)^{\frac{1}{2}}$ field dependence is still a feature of the two-band expression. This expression is used to explain the purity dependence observed in the ultrasonic attenuation in superconducting niobium placed in high magnetic fields. (auth)

1125 REGULAR FLUX JUMPS IN THE MIXED STATE OF NIOBIUM. Levy, M.; Kagiwada, R.; Carsey, F.; Rudnick, I. (Univ. of California, Los Angeles). Phys. Rev., B; 2: 2804-7 (1 Oct 1970).

Unusually regular flux jumps are reported in the mixed state of niobium. The most prominent experimental effects produced by these flux jumps are thermal spikes. The effect of the flux jumps on the ultrasonic attenuation coefficient is also reported. The regularity of the interval between the flux jumps is believed to be caused by a surface barrier. The thermal spikes are interpreted as being due to avalanching of the flux lines at the surface barrier. (auth)

1126 TYPE-I AND TYPE-II SUPERCONDUCTIVITY IN WIDE JOSEPHSON JUNCTIONS. Schwidtal, Klaus (Army Electronics Command, Fort Monmouth, N. J.). Phys. Rev., B; 2: 2526-32 (1 Oct 1970).

The magnetic field dependence of the maximum dc Josephson current I_{max} of wide Pb/PbO_x/Pb Josephson junctions, for which the junction length L was about 10 times the Josephson penetration depth λ_J, was measured. The experimental data are in excellent agreement with a theoretical prediction by Owen and Scalapino, who have numerically calculated I_{max} versus H_e for a Josephson junction with $L = 10\lambda_J$, and who have also shown that the Meissner region and the vortex structure are reflected in the I_{max} vs. H_e curve in a very characteristic way. It is shown that the boundary conditions of Owen and Scalapino's model can be most conveniently fulfilled with a cross-type junction configuration, and that the PbO_x tunneling barrier layers were fairly uniform. (auth)

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1127 MAGNETIC PROPERTIES OF SUPERCONDUCTING TANTALUM–NIOBIUM ALLOYS. Kubota, Yoji; Ogasawara, Takeshi; Yasukochi, Ko (Nihon Univ., Tokyo). J. Phys. Soc. Jap.; 29: 1209-24(Nov 1970).

The superconducting properties of Ta-rich Ta–Nb alloys were investigated by magnetization measurements. The Ginzburg–Landau parameter κ of pure tantalum is estimated to be 0.42 and the critical value $\kappa = 1/\sqrt{2}$ is attained at a composition Ta–2.4 at. % Nb. The dependence of the thermodynamic critical field on temperature T follows the BCS prediction and all the alloys are considered to be weak-coupling superconductors. The lower critical field accords with the microscopic theory in the vicinity of the transition temperature T_c, but the discrepancy between experiment and theory increases with decreasing T. The temperature dependence of the upper critical field and the generalized Ginzburg–Landau parameter κ_2 is stronger than the prediction and the disparity becomes large as the electron mean free path l increases. These properties may be ascribed to the effect of the anisotropy of the electronic structure in the state where the electron mean free path l is considerably larger than the intrinsic coherence length ξ_0. (auth)

1128 THEORY OF THE STRUCTURAL TRANSITION IN Nb_3Sn AND V_3Si. Pytte, E. (IBM Watson Research Center, Yorktown Heights, N. Y.). Phys. Rev. Lett.; 25: 1176-80(26 Oct 1970).

A dynamic theory, based on the electron–phonon interaction, of the cubic-to-tetragonal transformation in the β-tungsten structure is presented. The theory explains why Nb_3Sn behaves differently from V_3Si and shows that the lattice softening does not influence the superconducting transition. (auth)

1129 MIXED-STATE THERMAL CONDUCTIVITY OF TYPE II SUPERCONDUCTORS. Lowell, J.; Sousa, J. B. (Oxford Univ.). J. Low Temp. Phys.; 3: 65-87(Jul 1970).

A detailed experimental investigation of the mixed-state thermal conductivity and its dependence on the magnitude and direction of the magnetic field with respect to the heat flow (θ = T, H) was made on pure ($l \gg \epsilon_0$), dilute, and dirty ($l < \epsilon_0$) type-II superconductors (Nb, NbMo, NbTa). For the pure case and at high fields, the conductivity K approaches its normal state value with an infinite slope dK/dH, apparently in the way predicted by the Maki theory, $K(H) - K_n = (H_{c_2} - H)^{1/2} \cdot \alpha(T)$. The temperature dependence of α agrees also with theory, although its magnitude considerably exceeds the theoretical value. The angular dependence $K(\theta)$ shows that, at high temperatures K is maximal when the heat flows along the fluxoid direction ($K_{||} > K_{\perp}$) whereas $K_{||} < K_{\perp}$ at low temperatures; these features are, again, in agreement with theory. At low fields, the excitations bound to the fluxoid cores do not take part in heat transport to any appreciable extent. For the impure samples, and at high fields, a linear increase of thermal conductivity with field was observed in the manner predicted by the Caroli–Cyrot theory. The linear behavior, however, extends well below H_{c_2}, and this cannot be explained by this theory. The magnitude of the slope at H_{c_2} is in reasonable agreement with theory (applicable in the dirty limit) for the most impure sample investigated ($Nb_{80}Mo_{20}$); for the other cases the experimental slopes considerably exceed the theoretical value; the discrepancy increasing with decreasing impurity content. The angular dependence $K(\theta)$ is now much weaker than for pure Nb and practically disappears at fields in excess of $\sim 0.6 H_{c_2}$. At lower fields, a certain amount of anisotropy due to the electronic component was observed. In addition, at very low fields the results give some indications of anisotropy due to the phonon component of the thermal conductivity. (auth)

1130 DENSITY OF STATES IN A SUPERCONDUCTING DOUBLE LAYER AT LOW TEMPERATURES. Gilabert, Alain (Faculte des Sciences, Nice); Romagnan, Jean-Pierre; Guyon, Etienne. Compt. Rend., Ser. B; 271: 552-5(21 Sep 1970). (In French).

From the Mac Millan model, the density of states in a superconducting tin lead double layer was calculated. The anomaly observed in lead lead oxide tin lead tunnel junctions was explained. (France)

1131 MAGNETIC FIELD SPLITTING OF THE QUASI-PARTICLE STATES IN SUPERCONDUCTING ALUMINUM FILMS. Meservey, R. (Massachusetts Inst. of Tech., Cambridge); Tedrow, P. M.; Fulde, Peter. Phys. Rev. Lett.; 25: 1270-2(2 Nov 1970).

Magnetic field splitting of the quasi-particle energy states in superconducting aluminum films was observed in a tunneling experiment. The magnitude of the splitting was found to be $2\mu H$ and is attributed to the magnetic moment of the quasi particles. The observed tunneling conductance is in qualitative agreement with theory. (auth)

1132 LIFETIMES OF PERSISTENT CURRENTS IN SUPERCONDUCTING LOOPS INTERRUPTED BY JOSEPHSON JUNCTIONS. Goldman, A. M. (Univ. of Minnesota, Minneapolis). Contract AT(11-1)-1569. J. Low Temp. Phys.; 3: 55-63(Jul 1970).

The lifetimes of quantized persistent current states of a superconducting loop interrupted by a single Josephson junction are estimated, using the techniques of random-noise theory. Numerical results are presented for physically realizable examples. In the calculations it is assumed that $RC(2eI_1/\hbar C)^{1/2} \ll 1$, a condition which may be satisfied by either a low-capacitance crossed-film junction or by a weak link. (auth)

1133 ONSET OF QUANTIZED THERMAL FLUCTUATIONS IN ONE-DIMENSIONAL SUPERCONDUCTORS. Lukens, J. E.; Warburton, R. J.; Webb, W. W. (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Lett.; 25: 1180-4(26 Oct 1970).

Measurements of the onset of the resistive transition and the current–voltage characteristics of "one-dimensional" single-crystal tin whiskers were extended to a sensitivity of 10^{-15} V. The thermally activated quantum phase slips proposed by Langer and Ambegaokar have been observed directly and their theory for the voltage, determined by the rate of phase slippage, has been verified together with the modification of the attempt frequency proposed by McCumber and Halperin. (auth)

1134 PLASTIC FLOW IN NORMAL AND SUPERCONDUCTING INDIUM. Hutchison, T. S.; Pawlowicz, A. T. (Royal Military Coll. of Canada, Kingston, Ont.). Phys. Rev. Lett.; 25: 1272-5(2 Nov 1970).

Changes in flow stress, which occur in indium at the transition from the normal to the superconducting states, were studied in a series of experiments in which strain rate, state, and temperature are changed independently. The results are consistent with a simple theory which associates the changes in flow stress with changes in activation volume and thus with the nature of the interaction between moving dislocations and obstacles. (auth)

1135 SUPERCONDUCTIVITY IN RARE EARTH–RUTHENIUM LAVES PHASES. Hillenbrand, B.; Wilhelm, M. (Siemens AG, Erlangen, Ger.). Phys. Lett.; 33A: 61-3(5 Oct 1970).

Higher transition temperatures than have been known heretofore were found for $LaRu_2$ as well as for $ScRu_2$ and YRu_2. Measurements were made of the superconducting transition temperatures in solid solutions $La_xCe_{1-x}Ru_2$. (auth)

1136 FLUCTUTATIONS OF THE SUPERCONDUCTING ORDER PARAMETER IN PERPENDICULAR FIELDS. Danner, S.; Baumann, F. (Univ., Karlsruhe, Ger.). Phys. Lett.; 33A: 82-3(5 Oct 1970).

In the case of thin amorphous Ga films, it is shown that the magnetic field influences the conductivity due to fluctuations of the order parameter. Measurements indicate that the films are strongly pinned. There is no evidence of a "dip" effect. (auth)

1137 SUPERCONDUCTIVITY OF THE MEMORY-TYPE CHALCOGENIDE $Te_{0.81}Ge_{0.15}As_{0.04}$. Sample, H. H. (Tufts Univ., Medford, Mass.); Gerber, J. A.; Neuringer, L. J.; Kaufman, L. A. Phys. Lett.; 33A: 119-20(5 Oct 1970).

A superconducting transition was observed in the memory-type chalcogenide material $Te_{0.81}Ge_{0.15}As_{0.04}$. Changes at H = 0 in χ' and χ'' of the ac magnetic susceptibility and of the dc electrical resistivity for H ≤ 1200 gauss were observed. (auth)

Equipment and Devices

Refer also to abstracts 344 and 435.

1138 RECENT ADVANCES IN THE PRODUCTION OF LOW TEMPERATURES. Lea, M. J. (Univ. of Lancaster, Eng.). Phys. Bull. (London); 21: 436-41(Oct 1970).

Some recent developments in the production of temperatures below 100°K are considered. Static cryostats requiring liquid helium are considered and the problems of obtaining suitable dewar material discussed. The problems of reduction of heat input by conduction and radiation into the liquid helium and how best to utilize the enthalpy of the evaporated gas are also indicated. The use of liquid hydrogen and the double chamber and inverted dewar methods for obtaining temperatures between 5.2 and 100°K are considered. Dynamic cryostats are discussed and their applications described. Low temperature developments in the fields of helium dilution refrigerators, adiabatic demagnetization, and Pomeranchuk cooling are discussed and the future of low-temperature research indicated. (UK)

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1139 PROBLEMS WITH STAINLESS STEEL FORMERS FOR SUPERCONDUCTING MAGNETS. Larbalestier, D. C.; King, H. W. (Imperial Coll. of Science and Tech., London). Cryogenics; 10: 410-12(Oct 1970).

The presence of up to 5% of a ferromagnetic martensitic phase was detected in an En 58B stainless steel, used as the former of a superconducting solenoid, after repeated cool-downs to 4.2 K. This observation is in direct contradiction to previously reported structural studies of the US equivalent of this material (AISI 321), leading to the conclusion that the detailed alloy specifications of all supposedly austenitic stainless steels should be critically re-examined in relation to their low temperature stability. (auth) (UK)

1140 EFFECT OF FORCED CIRCULATION ON HEAT TRANSFER WITH LIQUID HELIUM IN NARROW CHANNELS. Jergel, M.; Hechler, K.; Stevenson, R. (McGill Univ., Montreal). Cryogenics; 10: 413-17(Oct 1970).

Experiments were carried out for heat transfer with liquid helium under conditions of forced circulation of the liquid through rectangular channels of width 1.0 cm and thicknesses 1.0, 0.6, and 0.3 mm. The channels had a fixed length of 50 cm. The circulation of liquid helium causes a very large increase in the maximum heat flux for nucleate boiling. Correlations are found for pressure drop and maximum heat fluxes, and maximum temperature differences appear to be significant parameters of the heat transfer and flow processes, and a general correlation of the laminar and turbulent flow data is found by plotting q/q_{max} against $\Delta T/\Delta T_{max}$. This correlation suggests differences in the heat transfer mechanisms for laminar and turbulent flow. Data are also given showing the process by which nucleate boiling is recovered after the transition from film boiling. (auth) (UK)

1141 ADVANCES IN CRYOGENIC ENGINEERING. VOLUME 15. Proceedings of the 1969 Cryogenic Engineering Conference, Los Angeles, June 16–18, 1969. Timmerhaus, K. D. (ed.). A Cryogenic Engineering Conference Publication. New York; Plenum Publishing Corporation (1970). 493p. $27.50. (CONF-690623).

Sixty papers are included; separate abstracts were prepared for sixteen. Topics covered are: liquefied natural gas technology, thermodynamic properties, fluid and solid properties, mechanical properties, superconductivity, superconducting magnets, heat transfer, insulation, fluid dynamics, gas purification systems, refrigeration systems, and cryogenic systems. (M.H.R.)

For abstracts of individual papers see: 435, 1088, 1089, and 1142–1154.

1142 REFRACTIVE INDEX OF LIQUID DEUTERIUM. Childs, G. E.; Diller, D. E. (National Bureau of Standards, Boulder, Colo.). Advan. Cryog. Eng.; 15: 65-9(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The refractive index of liquid deuterium is often required for the analysis of data obtained from high-energy physics experiments which use bubble chambers containing this liquid as a radiating medium. A method that can be used to compute accurate refractive index values for deuterium throughout a wide range of temperatures, densities, and wavelengths is described. A few representative values of the refractive index of saturated liquid deuterium are presented for illustration. (M.H.R.)

1143 LOW-TEMPERATURE ELECTRICAL RESISTIVITY OF SOME ENGINEERING ALLOYS. Clark, A. F.; Childs, G. E.; Wallace, G. H. (National Bureau of Standards, Boulder, Colo.). Advan. Cryog. Eng.; 15: 85-90(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The electrical resistivities of twenty-two engineering alloys were measured at five temperatures between liquid helium temperature and the ice point with a dip probe. This was done to provide engineering data for many of the newer alloys and to look for correlations and predictive schemes within alloy systems and also between various conditions of a given alloy. The electrical resistivities of some alloys were measured in different heat-treated alloys. Most of the alloys showed a smooth decrease in resistivity with decreasing temperature, but many had a shallow minimum at low temperatures. Comparisons are made between alloys and between different heat treatments of a group of representative alloys. For one of the comparisons, four similar alloys from four different manufacturers were used. (M.H.R.)

1144 MAGNETIC SUSPENSION AND GUIDANCE FOR HIGH-SPEED TRAINS BY MEANS OF SUPERCONDUCTING MAGNETS AND EDDY CURRENTS. Guderjahn, C. A.; Wipf, S. L. (Atomics International, Canoga Park, Calif.). Advan. Cryog. Eng.; 15: 117-23(1970).

Suspension and guidance of high-speed trains may be accomplished by eddy-current repulsion between moving superconducting coils (on the train) and stationary sheets of copper or aluminum. The stationary sheets are formed into a channel through which the magnet moves. In order to reduce drag, ferromagnetic material can be used to provide a composite channel of iron and aluminum. The iron provides part of the lift without eddy-current drag. The attractive force to the iron can be limited to provide a stable suspension by saturation of the iron and penetration of the flux to the conducting sheet behind the iron. Lift and drag forces for several practical configurations of magnet and sheets are given. These forces were determined by direct force measurement on models. The lift-to-drag ratio is acceptable and can be considerably improved. The use of this method of suspension is dependent on the construction of light-weight, high-current-density superconducting magnets. A suitable magnet can be constructed that will support 150 times its weight. (M.H.R.)

1145 SUPERCONDUCTING (Nb–Ti) LIQUID HELIUM LEVEL DETECTOR. Efferson, K. R. (Ok Ridge National Lab., Tenn.). Advan. Cryog. Eng.; 15: 124-31(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

A simple superconducting Nb–Ti liquid helium level detector was designed and tested. The desirable characteristics of this detector are: a continuous linear indication of liquid helium level; a large signal output (0.22 V/cm at 50 mA); operation in a high magnetic field (75 kG); relative ease of construction requiring no complicated electronics; and reproducibility. The level detector uses the difference in heat-transfer properties of liquid and gas phases of helium to produce and maintain a normal zone only in that portion of a high-field superconducting wire that is above the liquid level. Thus, the length of the detector above the liquid level is directly related to the normal-state resistance of the Nb–Ti wire. (M.H.R.)

1146 DESIGN OF A ROTATING DEWAR AND FIELD WINDING FOR A SUPERCONDUCTING ALTERNATOR. Thullen, P.; Smith, J. L. Jr. (Massachusetts Inst. of Tech. Cambridge). Advan. Cryog. Eng.; 15: 132-40(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The following topics are discussed: electrically imposed design constraints, the design of a preliminary experiment, dewar design philosophy, field winding construction, and testing. This series of tests run on a small experimental superconducting field winding contained in a rotating dewar vessel indicates that there are no fundamental restrictions to the construction of a large-size turboalternator of this configuration. (M.H.R.)

1147 CONSTRUCTION OF THE 12-FOOT BUBBLE CHAMBER SUPERCONDUCTING-MAGNET CRYOSTAT. Jones, R. E.; Martin, K. B.; Purcell, J. R.; McIntosh, G. E.; McLagan, J. N. (Argonne National Lab., Ill.). Advan. Cryog. Eng.; 15: 141-9(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The magnet design, the cryostat design criteria, the lower coil assembly, the helium vessel design assembly, radiation shield and insulation assembly, vacuum vessel and valve-box assembly, refrigeration and transfer lines, magnet adjustment, and emergency dump systems are described. The economics of a superconducting magnet versus a conventional magnet is mentioned. (M.H.R.)

1148 BIM, A LARGE 10-MJ MAGNET. Berruyer, A. (Centre d'Etudes Nucleaires, Saclay, France); Blondet, R.; Bronco, G.; Holtz, J.; Krikorian, J.; Neel, J.; Solente, P. Advan. Cryog. Eng.; 15: 158-66(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

A 10-MJ magnet producing a central field of 4 T is described. The following topics are covered: system description, cryostat description, refrigeration, and experimental results. (M.H.R.)

1149 DESIGN AND OPERATION OF AN 88-kG 20-IN.-BORE SUPERCONDUCTING MAGNET SYSTEM. Lucas, E. J. (Magnetic Corp. of America, Cambridge, Mass.); Stekly, Z. J. J.; de Winter, T. A.; Laurence, J. C.; Coles, W. D. Advan. Cryog. Eng.; 15: 167-77(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The design of a large superconducting-magnet system should integrate all requirements for such a system into a functional unit by considering the system's major problems in the mechanical, thermal, and electrical areas and provide mutually com-

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patible solutions to these problems. The results of such a design and some of the analytical and experimental work carried out to provide the answers to these problem areas are reported. The entire system consists of a set of four 20-in.-bore, 50-kG solenoids, two of which have been built and tested. (M.H.R.)

1150 PERFORMANCE TESTS OF 51-cm-BORE SUPERCONDUCTIVE MAGNETS FOR A MAGNETIC-MIRROR APPARATUS. Laurence, J. C.; Coles, W. D.; Brown, G. V.; Meyn, E. H. (Lewis Research Center, Cleveland). Advan. Cryog. Eng.; 15: 178-83(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

A superconducting magnetic-mirror apparatus (SUMMA), which will consist of several 51-cm-bore superconductive magnets, is discussed. The magnets are described and test results are tabulated. The charging time of the magnets was found to be two to three times the design time. The magnets did not reach the required fields at 4.2°K. (M.H.R.)

1151 FORCE-REDUCED SUPERCONDUCTING TOROIDAL MAGNET COILS. Boom, R. W. (Atomics International, Canoga Park, Calif.); Laurence, J. C. Advan. Cryog. Eng.; 15: 184-9(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

Force-free magnets wound with superconductors are studied to see if such superconductor turns carry unusually high current, since short-sample superconductors in longitudinal fields carry currents up to ten times higher than in transverse fields. The maximum current found, 63 A, is an intermediate value, above the 20 A usually obtained for small magnets of this material but less than the 170-A short-sample value. This suggests that force-free magnets of superconductors might be economical and lead to conductor cost and weight savings. (M.H.R.)

1152 DETECTION OF TRANSITIONS IN SUPERCONDUCTING COILS. Burnier, P. H.; Moreau, J.; Vassal, G.; Delume, M.; Tram, C. (Societe Alsthom, Massy, France). Advan. Cryog. Eng.; 15: 190-6(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

The principle and design of a new device incorporating a special coil are described and an attempt is made to interpret the preliminary results obtained. The principle used is to wind an auxiliary coil concurrently with the main coil, the insulated auxiliary conductor being placed side by side close to the superconducting wire. It is shown that only an auxiliary coil that is imbedded in a superconducting winding has the capability of detecting, without distortion, any type of signal occurring in the entire magnet. (M.H.R.)

1153 SURVEY OF HEAT TRANSFER TO NEAR-CRITICAL FLUIDS. Hendricks, R. C.; Simoneau, R. J.; Smith, R. V. (Lewis Research Center, Cleveland). Advan. Cryog. Eng.; 15: 197-237(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

Near-critical heat transfer is surveyed including the following areas: thermal properties; heat-transfer boundaries of the near-critical region; free, natural, and forced convection experiments; oscillations; geometric effects; parameters that appear to be significant to heat transfer in the critical region; and theories that have been proposed. (M.H.R.)

1154 CORRELATION OF THE DEPTH EFFECT ON FILM-BOILING HEAT TRANSFER IN LIQUID He II. Steed, R. C.; Irey, R. K. (Univ. of Florida, Gainesville). Advan. Cryog. Eng.; 15: 299-307(1970).

From Advances in Cryogenic Engineering Conference, Los Angeles, Calif. See CONF-690623.

An experimental correlation of the effect of depth on film-boiling heat transfer with vapor-film geometry as determined from motion picture studies is presented. It was shown experimentally that an interface heat flux can be determined experimentally and is dependent only upon the local thermodynamic equilibrium state. In addition, if it is assumed that the interface temperature is the local saturation temperature, then an interface heat-transfer coefficient is dependent only upon bath temperature. (M.H.R.)

Plasma and Thermonuclear Physics

Refer also to abstract 180.

1155 TECHNOLOGY INDEX FOR PLASMAPHYSICS RESEARCH AND FUSION REACTORS. VOLUME 4, NO. 8, 1970. Bibliography, Author Index, Subject Index, Appendix. Frankfurt am Main; Zentralstelle fuer Atomkernenergie-Dokumentation (1970). 41p.

This listing includes 192 articles on various aspects of controlled thermonuclear research and plasma physics. (M.O.W.)

1156 PLASMA PHYSICS INDEX. VOLUME 5, NO. 9, 1970. Bibliography, Author Index, Subject Index. Frankfurt am Main; Zentralstelle fuer Atomkernenergie-Dokumentation (1970). 106p.

This listing includes 499 articles on various aspects of plasma physics. (M.O.W.)

Confinement and Heating

Refer also to abstracts 1150, 1199, and 1218.

1157 (CEA-CONF-1596) KINETIC THEORY OF ANOMALOUS DIFFUSION DUE TO A DRIFT DISSIPATIVE INSTABILITY. Rolland, P. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 3p. (CONF-700817-21). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

A kinetic theory of classical and anomalous diffusion is presented, taking into account the average of the quadratic effects associated with the presence of a drift-dissipative instability. The results enable the study of the saturation mechanisms of the instability. (tr-auth) (France)

1158 (CEA-CONF-1599) QUASIPERIODICITY PROPERTIES OF PARTICLE MOTION IN RF SUPPLEMENTED TRAPS. Ichtchenko, G. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-17). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

Plasma confinement in a rf supplemented magnetic trap was studied in the single-particle approximation. The conditions for quasi-resonant and for exact-resonant interaction were determined. The mean energy exchange between particles and field was computed as a function of the initial velocity. The influence of elastic collisions on particle confinement was studied by introducing random deflections of the velocity vector. (tr-auth) (France)

1159 (CEA-CONF-1603) RECENT RESULTS FROM THE PLEIADE MIRROR DEVICE. Geller, R.; Jacquot, B.; Jacquot, C. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-13). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

Energetic electrons ($W_{\perp}^{-} \gg W_{\parallel}$) were trapped in a magnetic mirror and energetic ions ($W_{\parallel} \gg W_{\perp}^{+}$) were confined by electrostatic potentials. The energetic particles had lifetimes of several milliseconds with $n^{K} T_{\perp} > 10^{13}$ eV/cm^3 and $W_{\perp}^{-} \sim W_{\parallel} \sim 1$ KeV. (tr-auth) (France)

1160 (CEA-CONF-1604) BUILDUP OF A PLASMA IN A MAGNETIC WELL WITH A MULTIENERGY AND MULTIANGLE NEUTRAL ATOM INJECTION SYSTEM. Dei-cas, R.; Hennion, F. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-12). Dep. NTIS (U. S. Sales Only).

Numerical calculations of the plasma buildup, anisotropy, and energy distribution are presented for a neutral multi-injection system (10 injectors) in a quadripolar coil. With an equivalent current of 0.72 A, $P_0 \sim 3 \times 10^{-6}$ torr, $B_0 = 10$ kG, well depth R = 2, a plasma having the following characteristics can be obtained: $n_i > 10^{13}$ cm^{-3}, $T_i \sim 5$ to 10 keV, $\Delta E/E > 1$; $T_{\parallel i}/T_{\perp i} \sim 0.4$ in a volume of 30 liters. (tr-auth) (France)

1161 (CEA-CONF-1605) RF ELECTRON PLUGS AND THEIR POSSIBLE APPLICATION IN THERMONUCLEAR RESEARCH. Canobbio, E.; De Barbieri, O.; Giuffre, S. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-8). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

The feasibility of increasing plasma lifetime in mirror machines by using resonant rf electron plugs was examined (for comparison the case of rf ion plugs was also briefly considered).

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An investigation into the basic physical mechanisms involved showed that a net thermonuclear power yield would require efficient plugging of 100- to 150-keV electrons over several hundred of deflections. (tr-auth) (France)

1162 (CEA-CONF-1606) NONLINEAR EFFECTS IN TRANSIT TIME MAGNETIC PUMPING. Canobbio, E. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-9). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

The conditions for the validity of the energy absorption of electromagnetic waves by magnetic pumping with transit time as derived by the linear theory were investigated. It is shown that, in very low-β plasmas, the heating rate is determined by Coulomb collisions rather than by Landau damping. (tr-auth) (France)

1163 (NP-18502) STUDIES OF DIFFUSION OF DENSE DECAYING PLASMA IN A STELLARATOR. Demirkhanov, R. A.; Baratov, D. G.; Malykh, N. I.; Merezhkin, V. G.; Stotland, M. A.; Ten, Yu.; Khil, Sh. V. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Sukhumi. Fiziko-Tekhnicheskii Institut). 1970. 14p. (In Russian). Dep. NTIS (U. S. Sales Only).

Helium plasma decay in a circular two-path stellarator with magnetic field variations from 6 to 12 kOe was studied under conditions in which the classical diffusion time is smaller than the Bohm time and the mean free path of electrons is considerably shorter than the system. The plasma density and temperature were $\sim 1 \times 10^{14}$ cm^{-3} and 0.6 eV, respectively. It is shown that, taking into account the recombination elimination of charged particles, the plasma confinement time as a function of magnetic field intensity and angle of rotational transform can be determined accurately with the hydrodynamic model of classical plasma diffusion in a toroidal helical magnetic field. (tr-auth)

1164 ACCELERATION MECHANISM OF ENERGETIC ELECTRONS IN THE θ PINCH. Murata, Hideo; Mashiba, Tadashi; Shiina, Shoichi; Sato, Kazuo; Ohnishi, Haruyuki (Nihon Univ., Tokyo). Kakuyugo Kenkyu; 25: 252-63(Jul 1970). (In Japanese).

Hard x rays were emitted from the θ pinch at low initial gas pressures. The acceleration mechanism of high-energy electrons responsible for hard x-ray emissions in the θ pinch was investigated. (auth) (Japan)

1165 MEASUREMENT OF FLUCTUATION LEVEL IN TURBULENT FLOW HEATING. Hamada, Yasuji (Tokyo Univ.). Kakuyugo Kenkyu; 24: 264-72(Jan 1970). (In Japanese).

Turbulent flow heating is an efficient means to supply energy to plasma. To clarify the mechanism of the turbulent flow heating, the measurement of excited fluctuation level is necessary. The author performed the measurement by observing plasma satellites, utilizing He 4922 and 4471 Å lines. Theoretical explanation is made about the satellite. Helium plasma was produced by Joule heating in a plasma betatron, and then heated in turbulence by the electrical field due to the discharge with a condenser of low residual inductance. The spectrometer was of Czerny–Turner type with a grating of 1200 grooves/mm. The slit width was 40 μ. The satellites were observed during $0 \sim 0.5$ μsec from the discharge. During $0.5 \sim 1.0$ μsec from the discharge, the satellites could no longer be recognized. This seems to correspond to the attenuation of fluctuation due to heating. The fine structure of the satellites could not be resolved in the present experimental condition. The energy of the fluctuating electric field was estimated to be about 1×10^{13} eV/cm^3. The degree of turbulence was 0.01, about a tenth of that measured by Demidov. (Japan)

1166 EFFECT OF LONGITUDINAL ELECTRIC FIELD ON TOROIDAL DIFFUSION. Rutherford, P. H.; Kovrizhnikh, L. M.; Rosenbluth, M. N.; Hinton, F. L. (International Centre for Theoretical Physics, Trieste, Italy). Phys. Rev. Lett.; 25: 1090-3(19 Oct 1970).

The driving toroidal electric field in Tokamaks is shown to lead to a significant pinching effect at low collision frequency. For $\beta_\theta = 8\pi p/B_\theta^2 < 1$, where B_θ is the poloidal field, this pinching is more rapid than outward diffusion in the banana and plateau regimes of toroidal transport theory. (auth)

1167 DIFFUSION OF ELECTRONS IN A MAGNETIC BOTTLE OF CUSPED GEOMETRY. Strijland, W. (FOM-Instituut voor Plasma-Fysica, Jutphaas, Netherlands). Physica; 47: 617-25(30 Jun 1970).

A low-density population of electrons is electrostatically confined in a cusp-type magnetic bottle. Collisions on the background gas cause the electrons to diffuse perpendicularly to the magnetic field lines. An expression for the containment time was derived by taking into account the geometry of the magnetic field and the particle density distribution. Variation of several parameters shows that theory and experiment are consistent. (auth)

1168 EXPERIMENTS ON SHOCK PLASMA HEATING IN A RAPIDLY RISING MAGNETIC FIELD. Kapitonov, V. A.; Kornilov, V. A.; Lagunov, V. M.; Nesterikhin, Yu. E.; Papyrin, A. N.; Ponomarenko, A. G. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 28-38(Mar-Apr 1970). (In Russian)

Experimental results are presented on the excitation of strong, collision-free shock waves (Mach number $M > 5$) with subsequent compression of the plasma by the magnetic field of a shock coil. A magnetic piston >20 kOe is created in about 10^{-7} seconds by a current generator, which is a long line at 250 kOe filled with water as a dielectric. The use of water was dictated by its high dielectric permeability of 80 which made it possible to realize a small wave resistance of 1 ohm at a total capacity of the system of 0.2 μF. At an initial deuterium plasma density of about 2×10^{14}/cm^3 the shock waves had a width of the front of $20\ c/\omega$ (omega (ω) is the ion plasma frequency) and a velocity of 5×10^7 cm/sec. After accumulation the ion energy determined from the neutron field was found to be >2 keV. Axial shock waves excited by the plasma current flowing under the shock coil were observed. (TTT)

1169 ELECTRON–ION RELAXATION IN A PLASMA PRODUCED BY ULTRASHORT LASER PULSES. Zakharov, S. D.; Krokhin, O. N.; Kryukov, P. G.; Tyurin, E. L. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 12: 80-1(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 115-18(20 Jul 1970).

Ion heating is considered in a laser-produced plasma in the case when the electronic heat conduction can be neglected. The case is considered for a dense high-temperature LiD plasma. Maximum attainable ion temperature versus initial electron temperature graphs are given. (M.O.W.)

1170 ION LIFETIME IN THE TOKAMAK-3 MACHINE. Artsimovich, L. A.; Gorbunov, E. P.; Petrov, M. P. JETP Lett. (USSR) (Engl. Transl.); 12: 62-4(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 89-91(20 Jul 1970).

An equation is described for the energy balance for the ions per unit volume. The equation applies in the case when the ions are heated mainly by heat exchange with electrons via Coulomb collisions. Data are given showing ion temperature, energy lifetime of the ions, and plasma density as functions of the time in Tokamak-3. (M.O.W.)

Diagnostics

1171 (AD-709185) INTERPRETING SPHERICAL LANGMUIR PROBE DATA FOR THE COLLISIONLESS CASE. Battle, E. L.; Couch, R. P. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering). 1970. 8p. (AFIT-TR-70-5). NTIS.

Techniques previously developed make it possible to reduce the interpretation of experimental Langmuir probe data to the reading of a single graph. The experimenter simply measures the electron temperature and one other parameter. The figures included in the document may then be consulted and the plasma potential and ion number density read directly therefrom without any iteration. (auth) (USGRDR)

1172 (EUR-CEA-FC-540) DENSITY MEASUREMENTS USING A LANGMUIR PROBE IN THE PRESENCE OF A MAGNETIC FIELD. Ripault-Misguich, Jacqueline (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). May 1970. 154p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis. Submitted to Paris Univ. (France). Faculte des Sciences.

An electron collection model was established using a plane probe placed parallel to the magnetic field. This model takes into account electron trajectories in the plane of the probe. The region in which the model is valid is limited by the following conditions: the dimensions of the probe being large compared to the Larmor electron radius, which is itself large in comparison with the Debye length; the mean free paths of the electrons and ions being large in comparison with the probe dimensions. In this domain, various limitations on the use of the probe were encountered, those due to the flatness of the probe, which must be within one Larmor electron radius, and those due to the finite response time of the plasma which limits the recording time of a characteristic. The measurement of N and T_e was independent

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of any hypotheses on the value of the ionic temperature. This fact could not be envisaged had the probe been placed perpendicular to the magnetic field. Over a wide range of plasma parameters, density measurements made with the probe were of a precision comparable to interferometric measurements, but for the same precision the probe covered a range from 10^{10} to 10^{9} cm^{-3} for field values between 500 and 2000 G. This method of measuring density and temperature was applied to the determination of the cold plasma parameters of the Bille-en-Tête experiment (both before and after the application of the heating process). The change in density for different positions of the probe was measured and a diminution in density due to an impulse heating effect was observed. Local and temporal density variations in the cold plasma led to a better understanding of the characteristics of the medium in which the instabilities are propagated. (France)

1173 (ORNL-TM-3093) FEASIBILITY STUDY OF A THOMSON SCATTERING MEASUREMENT OF THE POLOIDAL MAGNETIC FIELD IN THE ORMAK-II. Murakami, M.; Clarke, J. F.; Kelley, G. G.; Lubin, M. J. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 30p. Dep. NTIS.

The feasibility of Thomson scattering to determine poloidal magnetic field in a Tokamak-type plasma is considered. The 15° scattering of the 10.6 μm CO_2 laser beam covers important ranges of the plasma parameters. Simple ways to unfold the scattering spectra are discussed. The method appears to be feasible, although it requires sophisticated technology, such as a high-power well-collimated CO_2 laser, a multichannel high-resolution Fabry–Perot interferometer, and low-noise infrared detectors. (auth)

1174 RADIAL AND LONGITUDINAL DISTRIBUTION OF CHARGE CARRIERS IN A DIFFUSION-CONTROLLED PLASMA. Chiplonkar, V. T.; Joshi, S. B. (Inst. of Science, Bombay). Indian J. Pure Appl. Phys.; 6: 190-1(1968).

Observations on the radial and the longitudinal distributions of charge carriers were made on a diffusion-controlled low-temperature active plasma. These show fairly good agreement with those expected theoretically. Radial variation of particle mobility, diffusion coefficient, and electron temperature were also measured. No evidence for negative ion formation was found. (auth)

1175 MEASUREMENTS OF ELECTRON TEMPERATURE AND DENSITY OF SLOW THETA PINCH PLASMA BY LASER SCATTERING. Hayase, Kiyoshi; Okuda, Takayoshi (Nagoya Univ., Japan). Denki Gakkai Zasshi; 90: 327-33(Feb 1970). (In Japanese).

The electron temperature and density of slow theta-pinch plasma were measured by means of laser light scattering. The slow theta-pinch apparatus was that employed as the plasma source in BSG-I and -II apparatuses. Helium gas was used. A giant pulse ruby laser of rotating-prism type with mean output of 10 MW at 6943 Å and pulse width of 30 ns was used for the measurement. The 90° scattering from the theta-pinch plasma was collimated, and the spectral distribution was measured with a Shimadzu monochromator GE 100 and a photomultiplier. The slit width was 10 Å. The measured spectral distribution of the scattered light for various conditions is shown. The time dependence of electron temperature and density calculated from the scattering experiment gave smooth extension of those measured by the magnetic loop method. It was shown that the scattering due to collective motion took place as well as the Thomson scattering. (Japan)

1176 RADIAL ELECTRON DENSITY AND ENERGY DISTRIBUTION PROFILES IN A CYLINDRICAL STEADY STATE ARGON PLASMA IN THE PRESENCE OF SMALL rf SIGNAL PERTURBATION. Chiplonkar, V. T.; Desai, Y. R. (Inst. of Science, Bombay). Indian J. Pure Appl. Phys.; 6: 130-2(Mar 1968).

A perturbing rf voltage signal externally introduced into a diffusion-controlled low-temperature cylindrical argon plasma was shown to have an insignificant effect on the radial profiles for the electron density and energy as compared to those obtained in the absence of the signal. Agreement between the experimental and the Schottky radial particle density profiles is fairly good when the constant b in Schottky's expression $n_r = n_o J_o(br)$ is determined for each condition by the probe measurements when it is located at the geometrical position of the wall. (auth)

1177 DIAGNOSTICS OF TP-D PLASMA BY CO_2 LASER. II. Nakatsuka, Masahiro (Osaka Univ.); Yokoyama, Masahiro; Yamanaka, Chiyoe; Izawa, Yasukazu; Toyoda, Koichi. Kakuyugo Kenkyu; 25: 192-8(Jun 1970). (In Japanese).

By using 10.6-μ infrared CO_2 laser radiation, measurements of steady TP–D plasma were carried out with interferometric and scattering methods. Electron density of TP–D plasma was normalized by Rayleigh scattering of pure air as a measuring standard. The measured electron density by interferometric and scattering methods as a function of the discharge current shows fairly good agreement. (auth) (Japan)

1178 STRONGLY IONIZED PLASMA COLUMN OF LOW PRESSURE DISCHARGE IN A LONGITUDINAL MAGNETIC FIELD. Kawaguchi, Motoichi (Nagoya Univ., Japan); Yamamoto, Kenzo; Itoh, Satoshi. Denki Gakkai Zasshi; 90: 281-6(Feb 1970). (In Japanese).

A strongly ionized plasma column in a longitudinal magnetic field was analyzed. The MHD approximation as given by Golant was employed. Nonlinear differential equations were derived for the stationary plasma. They were solved by numerical integration with appropriate boundary conditions. The numerical integration was performed according to the Runge–Kutta–Gill method. The calculated density distribution is shown and compared with that of a positive column in glow discharge (Jo distribution). For the strongly ionized plasma, the calculated distribution turns out to be more uniform. As the longitudinal field increases, the column contracts. The density distribution approaches the Jo distribution with the decrease of Coulomb collisions. This is explained as the effects of Coulomb interaction and of the magnetic field on diffusion. The current–voltage characteristics and the dependence of electron temperature on the magnetic field were obtained. (Japan)

1179 RADIAL PARTICLE DISTRIBUTION PROFILE IN LOW-TEMPERATURE GAS DISCHARGE PLASMA. Chiplonkar, V. T.; Joshi, S. B. (Inst. of Science, Bombay). Indian J. Pure Appl. Phys.; 6: 649-50(1968).

Experimental and theoretical discrepancies of the radial distribution profiles of charge carriers were shown to be accounted for in terms of volume recombination. From the observations, an estimate of the coefficient of volume recombination near the axis and near the wall was made for argon plasma (p = 400 microns; I_c = 4 mA; and V_c = 520 V). The estimated values are comparable to those reported in the literature under similar conditions. (auth)

1180 SCATTERING OF AN ION BEAM ON TURBULENT PLASMA OSCILLATIONS. Koidan, V. S.; Ponomarenko, A. G.; Rogozin, A. I. (Inst. of Nuclear Physics, Novosibirsk, USSR). Dokl. Akad. Nauk SSSR; 191: 1260-2(21 Apr 1970). (In Russian).

In order to explain the physical mechanism at the basis of turbulent plasma heating it is desirable to carry out experiments associated with establishing a spectrum of collective oscillations and the degree of turbulence of these oscillations. Calculations show that if the phase velocity of the oscillations is less than the velocity of the probing beam, the average square displacement of the beam particles can be related to the mass and velocity of the beam particles, the beam path in the plasma, the distance from the plasma to the point where the beam is measured, the characteristic wave vector of the oscillations and the energy density of the oscillations. The experiment was carried out in a turbulent plasma of a direct, high-voltage discharge. A glass chamber 5.5 cm in diameter was filled with air to a pressure of 10^{-4} mm Hg std. Initial gas ionization was produced in a homogeneous magnetic field H = 200 Oe by means of a Penning discharge (C = 0.5 microfarads, R = 200 ohms). The type of turbulence depended on the particle concentration and electron temperature of the initial plasma. A 50-keV proton beam 2 mm in diameter at 20 μA interacted with the plasma at a distance 15 cm from the cathode. The widening of the beam was determined, and related to collective oscillations of the plasma. (TTT)

1181 INFLUENCE OF THE APERTURE ON PLASMA PARAMETERS DURING DIAGNOSTICS BY METHOD OF SCATTERING. Pyatnitskii, L. N.; Khaustovich, G. P.; Korobkin, V. V. Teplofiz. Vys. Temp.; 7: 359-61(Mar-Apr 1969). (In Russian).

Diagnostics of plasma by the laser radiation scattering method are based on studies of the scattering spectra. Curves showing the influence of aperture on scattering spectra are given, and tabulated data are included for the studies at an angle 90°, a very large angle; calculations at smaller angles proved too cumbersome. (R.V.J.)

1182 DIAGNOSTICS OF HYDROGEN PLASMAS BY BEAMS OF HELIUM ATOMS OF VARIOUS ENERGIES. Alinovskii, N. I. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 7-11(Mar-Apr 1970). (In Russian)

A method of hydrogen plasma diagnostics using beams of helium atoms of various energies is described. The method proved to be quite effective for relatively high-density plasma ranging from

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10^{-14} to 10^{-16} cm^{-3} with probed plasma length ≈10 cm. The highest accuracy of ≈ ±20% was reached at the middle of the range. For electron temperature of 10 to 50 eV, the order of error did not exceed 10 to 30%. Cross sections for interactions of helium atoms with various components of hydrogen plasma are presented as functions of beam energy. (R.V.J.)

1183 MEASURING MAGNETIC FIELDS IN PLASMAS BY MEANS OF LIGHT SCATTERING. Kellerer, Leonhard (Institut fuer Plasmaphysik, Garching, Ger.). Z. Phys.; 239: 147-61 (1970).

Magnetic fields in a plasma were determined by a laser scattering experiment. The experimental data were: electron density 10^{16} cm^{-3}, electron temperature 3.2 eV, scattering angle 90°, scattering parameter $\alpha = 0.6$, and a maximum field in the plasma of 125 kG. The spectrum measured at the maximum magnetic field was modulated with 3.6×10^{11} Hz. In scattering experiments with a field reduced by about 20%, the observed modulation frequency was 2.8×10^{11} Hz. A thermal spectrum with a smooth profile was found when no field was present in the plasma. Applying the theory of cyclotron-modulated spectra, one obtains from the scattering experiment magnetic fields of 128, 100, and 0 kG. Within the experimental accuracy these values agree well with the fields determined by means of magnetic probes. Other possible interpretations of the measured deviations from thermal spectra (modulation with the plasma frequency or additional cold electron components in the plasma) are discussed, but they afford no explanation. This experiment has demonstrated that magnetic fields in plasmas can be measured locally and almost without disturbance by means of light scattering. (auth)

1184 RF IMPEDANCE METHOD FOR DETERMINING THE ELECTRON DENSITY AND COLLISION FREQUENCY IN A PLASMA. Basu, J.; Sen, C. (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Pure Appl. Phys.; 7: 75-6(Jan 1969).

An rf impedance method for plasma diagnostics is outlined. It is shown that the electron density and collision frequency in a plasma can be determined by measuring, at two frequencies, the impedance between two plane probes immersed in the plasma and biased with a suitable voltage. (auth)

1185 METHOD AND APPARATUS FOR OBTAINING A HIGH-SPEED AND HIGH-RESOLUTION RECORD OF THE SPECTRAL PROFILE OF A LUMINOUS SOURCE. Clement, Michel; Jacquot, Claude; Stevenin, Pierre (to Commissariat a l'Energie Atomique). British Patent 1,205,779. 16 Sep 1970. Priority date 13 Jan 1967, France.

An electro-optical spectrometer is combined with a Fabry–Perot interferometer for analysis of a luminous source. The Fabry–Perot interferometer is used as a high-speed analyzer of spectral profiles. (M.O.W.)

1186 LIGHT SCATTERING FROM A STRONGLY INHOMOGENEOUS PLASMA. Hayase, K.; Okuda, T. (Nagoya Univ., Japan). Phys. Lett.; 33A: 132-3(5 Oct 1970).

The spectrum of the scattered light from an inhomogeneous plasma is strongly modified at large α, and from which the average value of the temperature and the density cannot be obtained. However, they can be determined accurately by a certain method. (auth)

Kinetics (General)

1187 (AD-707347) PLASMA ANALYSIS VIA A RIGID ROTATION MODEL. Powell, W. Richard; Stainer, Howard M. (Johns Hopkins Univ., Silver Spring, Md. Applied Physics Lab.). Apr 1970. Contract NOw-62-0604. 42p. (APL-TG-1110). NTIS.

A combined experimental and theoretical study was made of a hydrogen–helium plasma produced by a conical theta-pinch gun that fires into an evacuated drift tube containing an axial magnetic field. The experimental input to the analysis includes the magnetic field on the axis, the flux ejected by the plasma, and the frequency of the radial ($m \pm 0$) oscillations of the puff. The background magnetic field in the drift tube and the electron temperature, determined from the ratio of the intensities of the He II (4686A) and He I (5876A) lines, complete the set of input parameters. The use of a previously developed rigid rotation model allows one to obtain specific density and magnetic-field profiles. A correction is then derived that enables both the fraction of the total azimuthal current carried by the ions and the ion temperature to be determined. The entire process was incorporated in a computer program that permits rapid processing of substantial amounts of data. Finally, the results of analyzing 39 puffs are tabulated. (auth) (USGRDR)

1188 (AD-709230) PHYSICS OF QUIESCENT PLASMAS. Jen, Norman C.; Auer, Gert (Innsbruck Univ. (Austria). Institut fuer Theoretische Physik). 4 May 1970. Contract F61052-70-C-0014. 45p. (UNICP-SR-71; AFOSR-70-1918-TR). NTIS.

A review is given on experimental work on the Q machine at The City University of New York and on its theoretical interpretation. First, the basic principle of the Q machine and a simple theoretical description are given, and a short recapitulation of probe theory is presented. Experiments on edge oscillations are described, and a theory is given that identifies them to be of Kelvin–Helmholtz type. In order to study phenomena occurring at weak magnetic fields, the plasma cameras were developed. By means of this new technique, the formation of convective cells was observed and was also derived from a simple fluid model. Finally, some results of the work concerning the helical instability are discussed. (auth) (USGRDR)

1189 (LA-tr-70-19) INVESTIGATION OF THE STABLE STATE OF TENUOUS PLASMA IN A Q-MACHINE. Gurevich, A. V.; Salimov, R. A.; Buchel'nikova, N. S. (Akademiya Nauk Ukrainskoi SSSR, Novosibirsk. Institut Yakernoi Fiziki). Translated by Helen Dahlby (Los Alamos Sientific Lab., N. Mex.) from report NP-17786. 15p. Dep. NTIS.

An abstract of this paper, prepared from the original language, appeared as NSA 23: 20898. (M.O.W.)

1190 PARTICLE CONCENTRATION PROFILES IN LOW-TEMPERATURE DIFFUSION-CONTROLLED GAS-DISCHARGE PLASMA. Chiplonkar, V. T.; Desai, Y. R. (Inst. of Science, Bombay). Indian J. Pure Appl. Phys.; 6: 148-9(Mar 1968).

Schottky's theory for radial density variation across a cross section of a longitudinally homogeneous plasma is confirmed over wide ranges of experimental parameters, assuming the particle density at the plasma boundary is nonzero on account of the formation of the sheath. (auth)

Kinetics (Experimental)

Refer also to abstract 974.

1191 (AD-707346) ANALYSIS OF IONS EXTRACTED FROM A PLASMA PUFF IN MAGNETIC GUIDE FIELDS. Leffel, C. S. Jr. (Johns Hopkins Univ., Silver Spring, Md. Applied Physics Lab.). Mar 1970. Contract NOw-62-0604. 43p. (APL-TG-1108). NTIS.

An iron skimmer and an extractor tube were used to extract ions from a high-beta plasma puff as it traveled down B_z and octopole magnetic guide fields. The plasma puff was generated by a theta-pinch plasma gun operating with hydrogen. The extracted ions were analyzed with a cross-field velocity analyzer in series with an electrostatic energy analyzer. For the case of the octopole guide field, analysis of the energy spectrum yielded values for the plasma parameters in good agreement with other determinations. For the B_z guide field, the magnetic field trapped in the extraction apparatus produced a magnetic barrier that reflected the plasma so as to distort the energy spectrum and produced temperature estimates that were too high and density estimates that were too low. However, for the B_z guide field, an upper limit could be placed on the concentration of impurity ions. (auth) (USGRDR)

1192 PARTIAL EQUILIBRIUM IN AN ARC SPECTRUM. Barach, John Paul (Vanderbilt Univ., Nashville). Phys. Rev., A; 2: 1474-77(1 Oct 1970).

Time-resolved spectra were taken of a pulsed arc operating in 2 torr of helium, CO_2, air, or argon. Wall confinement aided by close-fitting return conductors produce a 3.5-eV arc plasma in local thermodynamic equilibrium (LTE) during the first 10 μsec. The electron density is 10^{17} cm^{-3}. Thereafter, the plasma cools and the silicon impurity rises. The arc temperature is limited by radiation losses. LTE is found among eight species, as expected at these values of N_e; but neutral helium is found to be about 1.5 eV cooler than the rest of the plasma. Such a result could cause large temperature errors in plasma diagnostics using He II/I line ratios. (auth)

1193 FINE STRUCTURE OF THE DISTRIBUTION FUNCTION OF AN ELECTRON BEAM INTERACTING WITH A PLASMA. Levitskii, S. M.; Nuriev, K. Z. (Kiev State Univ.). JETP Lett. (USSR) (Engl. Transl.); 12: 119-20(20 Aug 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 172-4(20 Aug 1970).

A cylindrical capacitor with a resolution of about 1% was used for distribution function measurements of an electron beam interacting with a plasma. The investigations were carried out with an electron beam of 5 mm diameter, and a current of 10 to 20 mA; the accelerating voltage could be varied from 300 to 1200 V. Typical distribution function and fine structure measurements are described. (M.O.W.)

1194 EXPERIMENTAL DETERMINATION OF THE ELECTRIC CONDUCTIVITY OF AN ARGON PLASMA IN A STABILIZED ARC. Baturin, V. A. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 153-61(Mar-Apr 1970). (In Russian)

A method of determining the electrical conductivity of a hot plasma as a function of the temperature is described. As a rule, an artificially produced plasma is not isothermal over its volume. Hence the effects associated with the conductivity have an integral character so that the interpretation of measurement results is complicated. It is assumed that the electric field tension is constant over a constant cross section of the arc. Since the plasma is at thermodynamic equilibrium, there is a definite relation between the conductivity and the temperature. Over a small interval the local conductivity can be expressed as a power function of the temperature. The integral conductivity can be obtained by integration of the temperature power function over a number of operating regimes. The calculations were carried out on a computer. With the use of this method the integral conductivity was determined for an argon plasma at atmospheric pressure and temperatures up to 13,500°K. The total length of the arc was varied from 4.86 to 12.3 cm. Optical measurements were made transverse to the arc. Mass flow rate of the argon gas was 0.02 and 0.05 g/sec. This method of determining the electrical conductivity was found to be reliable by comparing the calculated arc currents with the measured currents under a wide range of conditions. (TTT)

1195 STUDY OF THE PROCESS OF INJECTING A PLASMA LOOP IN A TRANSVERSE MAGNETIC FIELD. Umarov, G. Ya.; Alimov, A. K.; Gaziev, U. Kh. (Inst. of Technical Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 1, 75-7(1970). (In Russian).

A molybdenum glass vacuum chamber (150 mm in diameter at the center) was made to decrease gas desorption. This chamber had two outlets at the ends with a magnetic probe at one end and an exhaust at the other end to a vacuum of 5×10^{-6} mg Hg std. The glass chamber was placed in a magnetic system consisting of two thick brass disks forming two turns which created the magnetic field. The capacity of the battery of condensers was 60 μF. The oscillation period of the system was 34.8 μsec. The total induction was 3.05×10^{-6} H. The primary current and total magnetic field at the center of the chamber were measured. The formation and oscillation of the plasma loop with a change in magnetic field on injection of the loop into the field was followed on oscillograms for each semiperiod of its oscillation. With decreasing magnetic field of the external system, the magnetic field of the plasma loop decreases also. The decrease in amplitude of the high-frequency field formed during oscillation of the plasma loop shows that the plasma loop has resistance. At constant magnetic field, the degree of gas ionization decreases with decreasing hydrogen concentration. At an unchanged gas pressure, the secondary current in the plasma loop also increases with increasing primary current. On increasing the condenser voltage to 30 kV at a hydrogen pressure of 10^{-2} mm Hg std, the oscillation amplitude of the magnetic field of the plasma loop increases. At lower pressures the plasma loop occurs in the second semiperiod of the oscillation of the external magnetic field. The observed high-frequency oscillations are rapidly dampened because of ohmic heating. If the energy of external high-frequency fields is used, further heating of the plasma loop can be carried out. (TTT)

Kinetics (Theoretical)

Refer also to abstracts 978, 1232, 1252, and 1349.

1196 (AD-707676) MIXED-BOUNDARY INITIAL-VALUE PROBLEM FOR VLASOV EQUATION. Evans, Kenneth Jr. (Illinois Univ., Urbana. Coordinated Science Lab.). Jun 1970. Contract DAAB07-67-C-0199. 22p. (R-473; UILU-ENG-70-218). NTIS.

The mixed-boundary initial-value problem for the Vlasov equation is treated by double Laplace transformation. It is found that certain relations must be satisfied by the boundary and initial values in order to have a well-defined problem. The case of a cold beam in a cold plasma is treated as a simple example. An approach to the problem via discrete velocities is treated in an appendix. (auth) (USGRDR)

1197 (AEC-tr-7163) HYDRODYNAMICS OF A PLASMA IN A STRONG HIGH FREQUENCY FIELD. Gorbunov, L. M. (Akademiya Nauk SSSR, Moscow. Institut Fiziki). Translation of report NP-18119. 60p. Dep. NTIS.

An abstract of this paper, prepared from the original language, appeared as NSA 24: 15308. (M.O.W.)

1198 (CEA-CONF-1609) AMBIPOLAR POTENTIAL EFFECTS ON COULOMB SCATTERING INTO THE LOSS CONE. Brambilla, M.; Werkoff, F. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-7). Dep. CFSTI (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

The Fokker-Planck equation describing Coulomb scattering into the loss cone in the presence of an ambipolar potential is written in a velocity coordinate system in which the loss hyperboloid was a coordinate surface. The equation is numerically solved for the case of ion-ion collisions. (tr-auth) (France)

1199 (CEA-CONF-1617) SIMULATION OF RF HEATING AND CONFINEMENT OF A PLASMA (COMPUTER-FILM). Shohet, J. L. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-23). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

A computer model of a plasma was used to demonstrate electron cyclotron heating and confinement by means of electromagnetic waves. The basic problem was to solve the Poisson equation for the self-consistent electric field and then add in the external rf field. The particles making up the plasma were then moved by solving their equations of motion simultaneously by means of a finite difference scheme. Heating and confinement could be shown effectively. (tr-auth) (France)

1200 (UCB-34-P-128-16) SECOND QUARTERLY PROGRESS REPORT OF 1970 ON PLASMA RESEARCH, 1 APRIL-30 JUNE 1970. (California Univ., Berkeley. Electronics Research Lab.). Contract AT(04-3)-34. 45p. Dep. NTIS.

Numerical simulation of plasmas is discussed. The theory for simulation and verification of the theory for plasma of finite-size particles are described. Computer simulation of plasma heating processes is discussed in some detail. (M.O.W.)

1201 CONNECTION BETWEEN ELEMENTARY COLLECTIVE COORDINATES AND THE VLASOV EQUATION. Percus, Jerome K. (New York Univ.); Yevick, George J. Phys. Rev., A; 2: 1526-32(1 Oct 1970).

A naive collective coordinate analysis leads to no damping of the acoustic modes of a classical fluid. A similar analysis of the linearized Vlasov equation leads to the well-known phenomenon of Landau damping. The qualitative form of Landau damping is, however, inaccurate for nonsingular forces and probably for low-k propagation in plasmas. Comparison of the two approaches shows that retention of the velocity variable in the Vlasov equation allows for an accurate description of positional fluctuations due to velocity dispersion by itself, but a poor assessment of collective forces. If, instead, the phase mixing of collective modes due to velocity dispersion is taken into account, a damping mechanism is introduced with the anticipated hydrodynamic form in fluids at low k, and with a k^4 dependence for plasmas. (auth)

1202 TRANSPORT PROPERTIES OF PLASMA USING SHIELDED LANDE POTENTIAL. Srivastava, M. P. (Indian Inst. of Science, Bangalore). Indian J. Pure Appl. Phys.; 6: 588-91(1968).

The expressions for the transport properties derived on the basis of the Boltzmann equation using Coulomb potentials involve divergence difficulties due to the fact that the usual potentials do not adequately represent the collision mechanism since the effects of the interaction at small and large distances are not taken into account. The influence of the presence of the surrounding particles, which shield the particle from interacting beyond the Debye shielding distance and the interaction at small distances, can be included by modifying the usual potential. The convergence of the integral involved in the expression for transport properties was obtained by employing the Debye-shielded Lande potential. Values for the viscosity and thermal conductivity were calculated following the method given by S. Chapman and T. G. Cowling (The mathematical theory of nonuniform gases, Cambridge Univ. Press Inc., New York (1953)) and these values were found to be in close agreement with those obtained by using the semiclassical quantum potential. (auth)

1203 HIGHER-ORDER THERMAL DIFFUSION OF ELECTRONS IN IONIZED GASES. Sharma, S.; Kaw, P. K. (Indian Inst. of Tech., New Delhi). Indian J. Pure Appl. Phys.; 6: 329-33(1968).

The nonlinear and second-order thermal diffusion of electrons in ionized gases was studied, using the techniques of the kinetic

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theory; the temperature dependence of the electron density was taken into account, in contrast to the assumptions of earlier workers. (auth)

1204 DIAMAGNETIC PLASMA CLUSTERS IN NONHOMOGENEOUS MAGNETIC FIELDS WITH NEUTRAL POINTS. An, Wo Hong. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; No. 3, 49-53(May-Jun 1969). (In Russian).

Formulas were obtained for equilibrium configuration of diamagnetic isotropic plasma in inhomogeneous magnetic fields with complex potential of type $\omega = z^n$, $n \geq 2$. Plasma shape was found for the case in which plasma occupied neutral point space (in which plasma boundary coincided with the power line $\Psi_0 = 0$). Results were applied in studies of solar bursts and magnetic traps with sharp-angle fields. (tr-auth)

1205 NONTHERMAL EFFECTS IN STARK BROADENING. Chappell, W. R.; Cooper, J.; Smith, E. W. J. Quant. Spectrosc. Radiative Transfer.; 10: 1195-1209(Nov 1970).

When an atom is immersed in a plasma the energy levels are broadened and shifted by the interaction with the fluctuating electric field of the plasma. The effect of this field on the spectral line shape by the use of results from plasma kinetic theory is discussed. In particular it is shown that in the equilibrium plasma the dominant effect is from single-particle collisions although correlation effects lead to a different result from the usual impact theory. In nonequilibrium plasmas the collective modes can become important and lead to appreciable satellites on the forbidden lines. In the case of a two-temperature electron gas the plasma wave effect is considerably enhanced. The possibility of observing the satellites in unstable plasmas is discussed and the relationship to quasilinear theory is given. In particular, it is shown that in isotropic systems the line shape can be used to directly observe the turbulent spectrum. (auth) (UK)

1206 DISTRIBUTION OF PLASMA DENSITY AND ELECTRIC FIELD TENSION AT AN ELECTRODE BOUNDARY. Stakhanov, I. P.; Shcherbinin, P. P. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 4-6(Mar-Apr 1970). (In Russian)

Near the cathode in an arc discharge, and also near the surface of a probe operating on the ionic branch of the volt–ampere characteristics, conditions are realized such that the Langmuir layer freely transmits ions coming out of the plasma, while the reverse ion current is practically equal to zero. Expressions are given to calculate the plasma density, the ion distribution, and the electric field near the electrode. The extrapolated length for the plasma density depends on the electron temperature and can be readily calculated. The absolute value of the electric field at the electrode boundary increases logarithmically. (TTT)

1207 EQUILIBRIUM CONCENTRATION OF POSITRONS IN AN OPTICALLY THIN RELATIVISTIC PLASMA. Bisnovatyi-Kogan, G. S.; Zel'dovich, Ya. B.; Syunyaev, R. A. (Applied Mathematics Inst., Moscow). JETP Lett. (USSR) (Engl. Transl); 12: 45-7(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 64-6(20 Jul 1970).

In a low-density plasma, when the radiation goes off freely, the positron concentration is determined by the equilibrium between the processes of pair production by collisions of e^- and e^+ with the nuclei and with one another. No detailed equilibrium takes place and the equilibrium thermodynamic formulas are not valid. The physical picture of the processes in such a plasma is described. (M.O.W.)

1208 QUANTUM-STATISTICAL EQUATION OF STATE OF STRONGLY IONIZED HYDROGEN PLASMA OF MEDIUM DENSITY. Rohde, K.; Kelbg, G.; Ebeling, W. Ann. Phys. (Leipzig); 25: 80-7(1970). (In German).

A quantum statistical formula for the equation of state of fully ionized plasmas in the mean temperature and mean density region is given. The complete second virial coefficient for the case of DEBYE screening is taken into account. The binary SLATER sums are represented by interpolation between the analytical expressions for small and for large radii, respectively. Using the interpolation formulas the equation of state is calculated numerically for the temperatures T = 20,000°K and T = 80,000°K. The resulting curves are in good agreement with the analytical equation of state for very small densities. (auth)

1209 NONEQUILIBRIUM EFFECTS IN STATIONARY RARE GAS PLASMAS UNDER NORMAL PRESSURE. Uhlenbusch, J.; Fischer, E.; Hackmann, J. (Technische Hochschule, Aachen). Z. Phys.; 239: 120-32(1970). (In German).

It is shown that, in wall-stabilized rare gas arcs under normal pressure, deviations from Saha equilibrium occur. These deviations are very strong for helium and neon, smaller for argon and krypton discharges, and are caused by diffusion of neutral and charged particles. A numerical method is described for the evaluation of temperature and density distributions from measured line intensities in the case of nonequilibrium, based on the balance equations of the arc plasma. Results are given for neon, argon and krypton arcs of radius 0.15 and 0.3 cm. A simple validity condition for local thermal equilibrium in a plasma with diffusion effects is derived. The influence of nonequilibrium on the determination of transition probabilities is discussed. (auth)

1210 BALANCE EQUATIONS AND TRANSPORT COEFFICIENTS FOR NONTHERMAL ARC PLASMAS. Preuss, E. (Technische Hochschule, Aachen). Z. Phys.; 239: 133-46(1970). (In German).

A closed set of balance equations, appropriate for the description of a nonthermal, stationary, cylindrical plasma column is derived from general 13-moment equations of the Boltzmann-equation. A 3-component plasma without external magnetic field is supposed, in which the electron temperature may differ from the gas temperature and ionization equilibrium may be influenced by the radial diffusion. Transport coefficients for the nonthermal case, such as electrical and thermal conductivity, ambipolar diffusion coefficient, and viscosity are defined and expressed in terms of the well-known integrals $\Omega^{(l,s)}$. (auth)

1211 RELAXATION BEHAVIOR OF NONEQUILIBRIUM ELECTRON PLASMA. Martinov, N. (Univ. of Sofia). Compt. Rend. Acad. Bulg. Sci.; 23: 359-62(1970).

The principal interaction between electron plasma and external electric field represents a nonlinear problem. In the interaction with a strong electric field this nonlinearity produces a particular effect on the type of quasi-stationary nonequilibrium distribution function of the electrons by velocity, as well as on the frequency of collisions and temperature of the particles. Here, the relaxation properties of nonequilibrium electron solid-state plasma are investigated during the nonlinear interaction, using a kinetic equation with a self-consistent field, the integral of collisions being represented by the Batnagar, Gross, and Krook model. (J.C.W.)

1212 KINETIC APPROACH TO THE COLLISIONAL POSITIVE COLUMN. Shioda, Susumu (Toshiba Research and Development Center, Kawasaki, Japan). Z. Angew. Math. Phys.; 21: 629-32(25 Jul 1970).

The velocity distribution function of ions near the plasma-sheath boundary was studied. The results of the Friedman nonlinear continuum theory were investigated by solving approximately the BGK-type equation that contains the unknown temperature to be determined, and then comparing the results with those of the Schottky linear diffusion theory. (M.O.W.)

1213 EFFECTS OF THE SPATIAL GRID IN SIMULATION PLASMAS. Langdon, A. Bruce (Univ. of California, Berkeley). J. Comput. Phys.; 6: 247-67(Oct 1970).

In earlier studies of simulation plasmas, the difference schemes for each step of the calculation have been analyzed, but their overall performance taken together with plasma behavior has not been treated carefully. A rigorous treatment is given of the spatial grid, giving a formulation that includes most codes now in use. This is done in such a way that the role of each step in the calculation is easily identified in the results, and also the expressions for plasma properties are easily compared with the corresponding "real" plasma properties. Details are given for the electrostatic case. The formulation is applied to the question of energy conservation, and to linear wave dispersion and instability. The effect of the spatial grid is to smooth the interaction force somewhat and to couple plasma perturbations to perturbations at other wavelengths, called aliases. The strength of the coupling depends on the smoothness of the interpolation methods used. Its importance depends roughly on how well the plasma would respond, in the absence of the grid, to wave numbers $k \sim 2\pi/\Delta x$; e.g., if the Debye length is too small, the coupling can destabilize plasma oscillations even in a thermal plasma. (auth)

1214 PROBLEM FOR THE NONLINEAR EQUATIONS OF PLASMA DYNAMICS. Telegin, V. I. (Moscow State Univ.). Dokl. Akad. Nauk SSSR; 192: 524-7(21 May 1970). (In Russian).

A plasma cylinder in a strong external field within a metal container is considered. The plasma consists of two types of particles of different mass, charge, and velocity. The magnetic field directed along the z axis depends only on the radial coordinate and is constant with time. The plasma is so dilute that the pressure and viscosity can be neglected. The particle movement is a rotation along a peripheral path. Movement in a radial plane can be described by a drift velocity. The behavior of the plasma within the cylinder is described by a quasi-linear set of equations (in dimensionless form). This formulation of the problem de-

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scribes the "chute" oscillations of a plasma cylinder. A theorem for the existence and uniqueness of the solution of the quasi-linear set of equations is formulated and proved. (TTT)

1215 POPULATION AND IONIZATION EQUILIBRIUM IN TWO-TEMPERATURE PLASMA. Suckewer, S. Phys. Lett.; 33A: 110-12(5 Oct 1970).

Formulas are obtained for the determination of the population of excited levels and the degree of ionization of atoms in optically thin, weakly ionized plasma of different electron and atom temperatures. The formulas obtained are then generalized for a plasma that was optically nonthin. (auth)

Production

Refer also to abstract 1169.

1216 (AD-709594) HOLLOW-BEAM-GENERATED PLASMA. Weiner, Maurice (Army Electronics Command, Fort Monmouth, N. J.). Jun 1970. 21p. (ECOM-3300). NTIS.

Theoretical plasma density and potential radial profiles are derived for plasmas generated by a hollow electron beam. Both collision-dominated (with neutral atom) and collisionless plasmas are considered. Separate solutions of the region occupied by the cylindrical beam and the central region are first obtained. The two solutions are then matched at the inner radius of the beam to obtain the complete solution. Results indicate that plasma in the central region has essentially constant density and potential, while in the beam region both density and potential decrease monotonically with increasing radius. It is argued that the absence of any plasma particle sources or sinks in the central region is responsible for the relatively uniform plasma. Experimental results on a Penning ionization gage discharge with an annular ring-shaped emitter confirm the uniform properties of the plasma in the hollow region. (auth) (USGRDR)

1217 (NP-18503) SOME PECULIARITIES IN PLASMA FORMATION BY MICROWAVE POWER NEAR ELECTRON CYCLOTRON HARMONICS. Budnikov, V. N.; Novik, K. M.; Obukhov, A. A. (Akademiya Nauk SSSR, Leningrad. Fiziko-Tekhnicheskii Institut). 1970. 11p. (In Russian). Dep. NTIS (U. S. Sales Only).

Plasma formation by 3-cm microwave power in a magnetic field was studied. Plasma was created in a quartz tube 70 cm long and with diameter 2.5 cm (up to 700 W). The experiments were carried out in argon at pressures 2×10^{-2} to 10^{-3} mm Hg. The effect of high-frequency plasma spreading along the magnetic field at values corresponding to electron cyclotron harmonics was investigated. The measurements by double probes were made along the tube. Fast electron groups with energy about 100 eV were shown to exist. Their formation was associated with the absorption of incident wave energy in a small volume because of the large absorption coefficient of plasma waves in the vicinity of cyclotron harmonics. (auth)

1218 ENTHALPY DISTRIBUTION IN PLASMA TUBE ARC HEATER. Kalra, Satya Pal (National Aeronautical Lab., Bangalore, India). Indian J. Pure Appl. Phys.; 6: 583-7(1968).

The energy transport and its distribution in a gas, flowing through a tube, across which an electric field is present was studied in the inlet flow region where the hot-gas core is covered by a cold-core region. The power loss occurring due to convection is assumed to be zero and the analytical expression deduced for various mass flux distributions gives the variation of enthalpy with the axial and radial coordinates of the hot-core region of the arc heater in the form of exponential and Bessel functions. In the cold-gas region, the variation of enthalpy at a fixed axial distance is logarithmic. The boundary of cold- and hot-gas core is a fixed enthalpy contour, which represents the minimum enthalpy required to start electrical conduction. (auth)

1219 APPLICATION OF LASERS FOR THERMONUCLEAR FUSION. Basov, N. G.; Krokhin, O. N. Vestn. Akad. Nauk SSSR; No. 6, 55-63(Jun 1970). (In Russian).

In view of the ability of lasers to deliver strong, coherent light pulses, these devices were examined as a means to create the very high temperatures needed for fusion studies. The high power of laser radiation made it possible to achieve power levels of about 10^{12} W, focused within a small spot, at an energy concentration of up to 10^7 J/cm^3, and an energy release of more than 10^7 W/cm^3 within the material. Because of the thus-created high pressure, the plasma would be unstable and the heating must be carried out in a pulsed mode. The experimental and theoretical problems arising from the use of lasers for this purpose are currently examined at the Physical Institute, the Institute for Applied Mathematics and the Institute for Terrestrial Physics of the USSR Academy of Sciences. It is expected that the direct heating of plasma by laser radiation focused on the surface of a solid deuterium plus tritium target will increase the thermonuclear yield under inertial confinement conditions and conductance heating techniques; the pulses would last for about 10^{-9} sec. Design of such lasers possessing the required energy level is considered realistic. (Review article) (TTT)

Stability

Refer also to abstract 1157.

1220 (AD-707116) NUMERICAL STUDY OF IONIZATION INSTABILITY IN LOW-TEMPERATURE MAGNETIZED PLASMA. Velikhov, E. P.; Degtyarev, L. M.; Favorskii, A. P. Translated by J. Miller from Chislennoe Issledovanie Ionizatsionnoi Neustoichivosti v Nizkotemperaturnoi Zamagnichennoi Plazme, 1969. 112p. (FTD-HT-23-241-70). NTIS.

The problem of the development of ionization instability in a low-temperature magnetized plasma is examined. Basic attention is devoted to the dynamics of the development of instability and a qualitative analysis of the phenomenon. The effectiveness of the physical model used as the basis of the examination is shown. As a result of the numerical calculations, the association between the average parameters of the plasma at process stages close to turbulence is refined. (USGRDR)

1221 (CEA-CONF-1615) NONLINEAR ELECTROSTATIC INSTABILITIES IN A MAGNETOPLASMA. Tataronis, J. A.; Teichmann, J. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-24). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

The existence of nonlinear instabilities in plasmas and the characteristics of parametric amplification of waves are discussed for the case of asymmetric coupling coefficients. (tr-auth) (France)

1222 (ORO-2454-14) INSTABILITIES AND TURBULENCE IN ALKALI VAPOR PLASMAS. Final Report. Robertson, Harry S. (Miami Univ., Coral Gables, Fla. Dept. of Physics). [Aug 1969]. Contract AT(40-1)-2454. 18p. Dep. NTIS.

A brief summary of the work is presented, together with its relationship to other work at the University of Miami in the same area. Topics treated are moving striations, anode-spot oscillations, helical instabilities in dc arc plasmas and in rf-excited electrodeless plasmas, quasi turbulence in strongly magnetized arc plasmas, diffusion of plasmas, and kinetic theory. (auth)

1223 EFFECT OF HIGH-FREQUENCY ELECTROMAGNETIC FIELD ON THE STABILITY OF A SLIGHTLY NONHOMOGENEOUS MAGNETIZED PLASMA. Demirkhanov, R. A.; Gutkin, T. I.; Lozovskii, S. N.; Nekrasov, F. M.; Sidorov, V. P. (Physical-Tech. Inst. of the State Committee on Utilization of Atomic Energy, Sukhumi, USSR). Physica; 47: 610-16(30 Jun 1970).

Investigations are described of the E-wave (i.e., the wave with the electric vector $E \sim \exp i\Omega t$ parallel to the constant magnetic field H_0) high-frequency field effect on the stability of some types of oscillations in a slightly nonhomogeneous collisionless magnetoactive plasma. (auth)

1224 STABILITY OF INTENSE QUASI-STATIONARY DISCHARGE IN A MAGNETIC FIELD. Kozak, O. V.; Pasechnik, L. L. (Kiev Inst. of Physics). Ukr. Fiz. Zh.; 14: 1900-3 (Nov 1969). (In Russian).

Previously it was shown that plasma properties beyond the axial region of the discharge in an intense quasi-static discharge in a magnetic field are determined by the diffusion in ion–electron collisions and by the volume of recombination. Moreover, the radial density distribution depends, significantly, on the strength of the external magnetic field. An attempt was made to determine the stability of the quasi-stationary discharge. The Langmuir probe was used for measuring the radial profile of the plasma density and recording oscillations generated by the discharge. The oscillations were also recorded by means of loop antennas distributed outside the chamber. Optical methods were used for recording electron temperature and for qualitative control of mixture input during various stages of operation. (R.V.J.)

1225 EXPERIMENTS WITH LARGE VALUES OF β_I IN TOKAMAK-3. Mirnov, S. V. JETP Lett. (USSR) (Engl. Transl.); 12: 64-6(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 92-5 (20 Jul 1970).

Experiments relating to magnetohydrodynamic stability in

Tokamak-3 when $\beta > 1$ are briefly discussed. The use of magnetic probes to determine β during this period is described. (M.O.W.)

1226 SUPERHEATING INSTABILITY IN AN OPTICALLY NONTRANSPARENT PLASMA DISCHARGE. Triger, S. A. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 39-41(Mar-Apr 1970). (In Russian)

Fluctuations in energy per unit volume are calculated for a nontransparent plasma discharge, where the average free path length of the quanta l is less than the characteristic dimensions of the system, and the wavelength of the oscillations in the direction of the inhomogeneity is less than l. It is shown that the energy fluctuation is completely determined by the fluctuations in temperature. The dispersion equation describing the plasma oscillation is similar in structure to the corresponding equation in a transparent discharge, and contains a superheating instability that cannot be suppressed by the thermal conductivity of the electrons. (TTT)

1227 ONE TYPE OF CURRENT INSTABILITY OF A PLASMA OF FINITE CONDUCTIVITY. Konkashbaev, I. K. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 47-9(Mar-Apr 1970). (In Russian)

A plasma column retained by a magnetic field is considered in which the Joule heat is lost by radiation and thermal conductivity. It is shown that a specific instability associated with pressure and conductivity gradients can exist in a dense, low-temperature plasma. The mechanism for the existence of this instability is analogous to convective-current and resistive instabilities. This instability is associated with a temperature perturbation. Therefore the thermal conductivity is a stabilizing factor. (TTT)

1228 PARAMETRIC EXCITATION OF A SPIRAL INSTABILITY OF THETA PINCH BY A HIGH-FREQUENCY, LONGITUDINAL CURRENT. Nikulin, M. G. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 21-7(Mar-Apr 1970). (In Russian)

Equilibrium conditions are given for a thin-ring theta pinch in a longitudinal magnetic field transverse to the plane of the ring, which excites a variable longitudinal current of high frequency in the loop. On the assumption of a flexible direct loop, the effect of the oscillation of small spiral perturbations is investigated. The conditions under which the parametric excitation may be suppressed are presented. Forced oscillations of the radii of a ring theta pinch under the effect of variable fields are briefly discussed. (TTT)

1229 QUESTION OF STABILIZATION OF BEAM INSTABILITY. Zaitsev, V. V. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 837-43(1970). (In Russian).

The conditions of instability when the beam interacts with plasma are obtained. The spectrum of plasma oscillations is assumed to be one-dimensional and the distribution function of the beam linearly dependent on the velocity. The cases of slow and fast beams are considered; the motion of the boundary of the instability region is taken into account for a fast beam. An analysis is made of the pulsating regime of instability which may occur under the conditions of stabilization, if the effects of plasma wave absorption are considered. (tr-auth)

1230 ELECTRON CYCLOTRON DRIFT INSTABILITY. Forslund, D. W.; Morse, R. L.; Nielson, C. W. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Lett.; 25: 1266-70(2 Nov 1970).

Electron cyclotron waves are shown to grow unstably in the presence of small relative drifts of a warm ion distribution perpendicular to the B field. Numerical simulations show that this instability causes anomalous diffusion of plasma across the magnetic field and heating of the electron thermal spread to values much greater than the relative ion–electron drift velocity. (auth)

1231 STABILITY INVESTIGATION OF THE PLASMA STREAM MOTION IN A DIVERTOR MAGNETIC FIELD. Zykov, V. G.; Karpukhin, V. I.; Rudnev, N. I.; Tolok, V. T. (Kharkov Inst. of Physics and Tech.). Ukr. Fiz. Zh.; 15: 1135-41(Jul 1970). (In Russian).

Plasma stream motion stability was investigated in the magnetic field of the divertor. It is shown that the divertor magnetic field is an effective stabilizing factor on the unstable motion of plasma in a longitudinal magnetic field. (auth)

1232 BOUNDARY CONDITIONS IN THE THEORY OF SYSTEMS OF MULTIPLE PARTICLES. Kasatkin, A. P. (Gorky Research Inst. of Tech. Physics, USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 3, 149-51(1970). (In Russian).

In considering the distribution function of ensemble systems, periodic boundary conditions are ordinarily selected, and it is assumed that the properties of the system of particles do not depend on the boundary conditions. A system of particles with Coulomb interactions is considered, with mirror reflection from the walls being assumed. On considering the properties of a plasma at small intervals of time it is found that there is a change in the dielectric penetrability. Thus, a new result is obtained in studying the stability of a plasma. The plasma is stable only under conditions of no flow of current. With mirror reflection the initial state of current may itself be unstable. (TTT)

1233 PINCH-EFFECT INSTABILITY AT LOW DENSITY. Igitkhanov, Yu. L.; Kadomtsev, B. B. Dokl. Akad. Nauk SSSR; 191: 1018-21(11 Apr 1970). (In Russian).

A plasma pinch, that is, a gas discharge drawn out by a particular magnetic field, is unstable. Constrictive and spiral perturbations develop in the plasma loop, which rapidly breaks down. An interesting case of an instability at low density is described here. With decreasing density, the ratio of the current electron velocity to the velocity of sound increases. In a pinch without a longitudinal magnetic field the acoustic velocity is of the order of the Alfven velocity. If the linear proton number becomes less than 10^{16}, the electron velocity exceeds the acoustic velocity. In this case the magnetic field is frozen into the electrons, and the entire physics for the development of instability changes. The ions become demagnetized. The Larmor radius exceeds the radius of the loop. An ideal, two-liquid magnetohydrodynamics must be used to describe the plasma dynamics. It is then shown that in a low-density pinch, strong instabilities should develop that correspond to resonance between helicons and Alfven waves. As in an ordinary diffusion pinch, spirals develop primarily in the interior and neck constrictions on the periphery. (TTT)

1234 INSTABILITY OF A HIGH-PRESSURE INHOMOGENEOUS PLASMA IN A HOMOGENEOUS MAGNETIC FIELD. Mikhailovskii, A. B. Dokl. Akad. Nauk SSSR; 192: 74-5(1 May 1970). (In Russian).

Plasma perturbations are considered with a frequency less than the cyclotron ion frequency, and the product of the longitudinal wave number times the thermal electron velocity. The transverse wavelength is greater than the Larmor radius. These perturbations are described by a local dispersion equation. The plasma is seen to be unstable with respect to these perturbations. If the plasma is described by two-liquid hydrodynamics equations, it is also shown that a collision plasma is unstable, if the frequency of the ion–ion collisions exceeds the frequency of the oscillations. An expression is obtained for the relaxation time of the plasma, which is found to coincide in order of magnitude with the time of diffusion of the magnetic field into the plasma. (TTT)

Thermonuclear Processes

1235 (CEA-CONF-1602) TORSATRON WITHOUT TOROIDAL FIELD COILS AS A POSSIBLE SOLUTION TO THE DIVERTOR PROBLEM. Gourdon, C.; Marty, D.; Maschke, E.; Touche, J. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-14). Dep. NTIS (U. S. Sales Only).

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

A stellarator-type configuration, with only helical conductors and no toroidal field coils, was investigated by numerical calculations. Interesting properties were found for the configurations with high aspect ratio ($R/a \sim 10$) (t up to 4, and $\rho/L_s \approx 1$). This configuration (Torsatron) is particularly well suited for the construction of a divertor. (tr-auth) (France)

1236 (NP-18505) ELECTRIC FIELD IN TOROIDAL METALLIC CHAMBER WITH SECTIONS. Stotland, M. A.; Khil, Sh. V. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Sukhumi. Fiziko-Tekhnicheskii Institut). 1970. 20p. (In Russian). Dep. NTIS (U. S. Sales Only).

A quasi-stationary approximation was developed for an electric field in a toroidal metallic chamber with meridional sections and equatorial plane sections designed for the penetration of an induction electric field. Equations were also obtained for the electric field outside of the current-carrying surface of the toroidal loop with meridional cross section. (tr-auth)

1237 (UCRL-50920) REQUIREMENTS ON RECOVERY EFFICIENCIES FOR MIRROR FUSION POWER SYSTEMS. Heckrotte, Warren; Hiskes, John R. (California Univ., Livermore. Lawrence Radiation Lab.). 20 Aug 1970. 27p. Dep. NTIS.

A parametric study of recovery efficiencies for different Q values is presented for a D–T system and for a neutron-free system. The properties of these fusion power systems are discussed with reference to their steady-state operation and to their tran-

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sient operation up to full-power level. The partitioning of energy among the plasma constituents (electrons, reacting ions, and reaction products) is calculated based on the paper of Kuo-Petravic, Petravic, and Watson. The energy distributions of the charged components leaving the plasma, especially the electrons, will bear on the design of the direct convertor. Some discussion is given on the relative merits of a D–T system vs a D–He system as a means of relaxing the requirements on the recovery efficiencies and the circulating power. (auth)

1238 CRITICAL SIZES OF FUSION FOR DYNAMICAL PLASMA IN HEAVY HYDROGEN ICE. **Freund, Hans-Dieter (Christian-Albrechts-Univ., Kiel). Atomkernenergie; 16: 162-3(1970).**

Dynamical plasmas produced by laser or electron beam irradiation of heavy hydrogen ice are studied. The atomic density is about $n = 10^{22}$, and therefore the pressure increases to 10^9 bar. In consequence, the plasma sphere expands rapidly due to the high pressure. Hereby, cold boundary matter is picked up and heated to the plasma state. In order to get the same temperature in the plasma boundary as in the center, the sphere must have a critical size. Critical size calculations were made for a 50% mixture of D and T and for pure deuterium. (M.D.W.)

1239 STABILITY OF A MAGNETIC WELL. **Benford, Gregory; Newcomb, William A. (Univ. of California, Livermore). Phys. Rev. Lett.; 25: 1085-6(19 Oct 1970).**

The Hastie–Taylor guiding-center stability criterion for magnetic-well equilibria of the "mod-B" type is extended to include the effect of quasi-rigid external currents such as those of an Astron E layer. (auth)

Wave Phenomena

1240 (CEA-CONF-1600) ELECTRON CURRENT AND DISTRIBUTION FUNCTION ASSOCIATED WITH AN ELECTRON PLASMA WAVE. **Guillemot, M.; Olivain, J.; Perceval, F.; Quemeneur, A.; Scharer, J. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-15). Dep. NTIS (U. S. Sales Only).**

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

The second-order time-independent electron current and distribution function were derived theoretically and measured experimentally. The results show that there is a deformation in the vicinity of the phase velocity of the wave. This deformation is related to the wave amplitude, wave spectrum, and distance from the source. (France)

1241 (CEA-CONF-1613) NUMERICAL SOLUTIONS OF THE FULL WAVE EQUATIONS IN AN INHOMOGENEOUS COLD PLASMA SLAB NEAR THE LOWER HYBRID RESONANCE. **Agnello, V.; Colombant, D.; Fieffe-Prevost, P.; Ichtchenko, G.; Kulinski, S. (European Atomic Energy Community. Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1970. 4p. (CONF-700817-3). Dep. NTIS (U. S. Sales Only).**

From 4th European Conference on Controlled Fusion and Plasma Physics, Rome, Italy.

The absorption of an electromagnetic wave in an inhomogeneous cold plasma slab is considered. For perpendicular incidence, the absorption coefficient presents sharp geometric resonances and depends strongly on the length of the region of evanescence. The case of oblique incidence is then discussed. The resistive loading of a coil imposing an axial wavelength was computed when the accessibility condition is fulfilled. It was found that this resistance varies little with density gradient and that the lower hybrid resonance may be masked by coupling resonances. (tr-auth) (France)

1242 (IPP-6/85) PROPERTIES OF MARGINALLY-STABLE COLLISIONLESS DRIFT-UNIVERSAL MODES WITH APPLICATION TO THE W-II STELLARATOR. **McCune, J. E.; von Hagenow, K. U. (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany). Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering). Apr 1970. 34p. Dep. NTIS (U. S. Sales Only).**

The marginal-stability properties of a class of collisionless drift universal plasma modes are studied numerically and analytically. The familiar "slab" model of plasma equilibria with gradients perpendicular to B is employed, and both hydrogen and barium plasmas are treated. This study extends earlier work in that specific information is provided that enables one to decide whether or not a given mode is unstable in a given machine; possible application to the Wendelstein (WII) experiment at low densities is discussed. Analytic formulas for the properties of the marginally stable modes are developed. The marginally stable modes divide roughly into three regimes: small m-number modes with sufficiently long parallel wave lengths first become unstable at relatively low densities ("low-density branch") and are then stabilized again as the density is increased ("high-density branch"); large m-number modes, by contrast, possess a critical parallel wave length which decreases monotonically with increasing density. Departure from quasi-neutrality is very important for these higher m-number waves; their frequencies at threshold are very small and inversely proportional to the critical parallel wave length. (auth)

1243 (NP-18504) LINEAR TRANSFORMATION AND ABSORPTION OF WAVES IN PLASMA. **Golant, V. E.; Piliya, A. D. (Akademiya Nauk SSSR, Leningrad. Fiziko-Tekhnicheskii Institut). 1970. 81p. (In Russian). Dep. NTIS (U. S. Sales Only).**

The theory of the linear wave transformation in plasma is considered on the basis of recent works. The coupling of electromagnetic and plasma waves in the region of nonuniform plasma where the "cold" refractive index has a singularity is analyzed in detail. The conditions for the transformation mechanism to become effective are discussed and a survey of the results on the transformation effectiveness is given. A review is given of experimental results on collisionless absorption of the high-frequency waves in the frequency region between the upper and the low hybrids. (A brief survey of plasma resonances is also included.) Analysis of the experimental data and their comparison with theory indicates that the experimentally observed absorption is accounted for, in a wide variety of conditions, by the linear transformation of the incident electromagnetic wave into a strongly damping plasma wave. The collisionless absorption due to the transformation can be useful in plasma heating in experiments aimed at controlled thermonuclear fusion. (auth)

1244 FORMATION OF DISCONTINUITIES BY NONLINEAR INTERACTION OF LOW-FREQUENCY ELECTROMAGNETIC AND ION-SOUND WAVES. **Rogister, A.; Dobrowolny, M. (International Centre for Theoretical Physics, Trieste, Italy). Phys. Rev. Lett.; 25: 1082-4(19 Oct 1970).**

Two coupled equations describing the nonlinear interaction of ion–acoustic waves and low-frequency electromagnetic waves are derived for the case where the two phase velocities are close to each other. These equations form a hyperbolic system, thus describing the formation of discontinuities, and can be relevant to the magnetic energy conversion problem in the physics of solar flares. (auth)

1245 NONLINEAR WAVE PROPAGATING ALONG MAGNETIC FIELD IN MULTICOMPONENT COLLISIONLESS PLASMA. **Pataraya, A. D.; Rostomashvili, Z. I. (Inst. of Nuclear Physics, Moscow). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 762-4(1970). (In Russian).**

Equations similar to the equations for nonlinear optics of weakly modulated waves were obtained previously for nonstable slightly nonlinear waves propagating along the external magnetic field in a two-component quasi-neutral cold plasma. An attempt is made here of finding an equation for a nonlinear nonstable wave propagating along the external magnetic field in a multicomponent quasi-neutral cold plasma. It is shown that the wave increment in a multicomponent plasma containing negatively charged ions is significantly smaller than the corresponding wave increment in a two-component electron–ion plasma. (R.V.J.)

1246 EXPERIMENTAL STUDY OF LOW-FREQUENCY OSCILLATIONS IN A CONFINED LOW-PRESSURE PLASMA PLACED IN A MAGNETIC FIELD. **Pasechnik, L. L.; Popovich, A. S. (Inst. of Physics, Kiev). Dokl. Akad. Nauk SSSR; 191: 1263-6(21 Apr 1970). (In Russian).**

A discharge was created by a heated cathode K and a copper cylinder A (44 cm long with an internal diameter of 4.5 cm). The diameter of the primary electron beam was limited by a diaphragm, connected with the cathode and having an inner diameter of 2.7 cm. Opposite the cathode a metallic end-piece T of the discharge chamber was insulated from A so that it was possible to change its potential independently of the conditions of the discharge. The discharge chamber was placed in a homogeneous magnetic field of up to 2000 oersteds. The working gas was helium at a pressure of 1 to 5×10^{-3} mm Hg std. The electron temperature was about 3 eV. The plasma density was varied from 5×10^9 to 5×10^{10} per cm by varying the discharge current. A system of probes was inserted to study the spacial distribution of the oscillations. Under the experimental conditions it was found that the main factor having an effect on the plasma stability was the potential of the end-piece T. With a decrease in potential of this end piece, it was observed that oscillations occurred in the plasma, whose intensity rapidly increased with decreasing potential. The frequency of the oscillations was 10 to 20 kc. The frequency of the oscillations did not depend on the magnetic field, gas pressure or

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plasma density, but did depend a great deal on the potential of the end-piece T. The excitation of these oscillations is related to the movement of ions in a longitudinal electric field. (TTT)

1247 EXCITATION OF ION–ACOUSTIC WAVES BY LANGMUIR WAVES AND STATIONARY REGIMES IN A BEAM–PLASMA SYSTEM. Bakai, A. S.; Kornilov, E. A.; Krivoruchko, S. M. (Physical-Technical Inst., Kiev). JETP Lett. (USSR) (Engl. Transl.); 12: 49-51(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 69-73(20 Jul 1970).

The threshold excitation of ion-acoustic waves by Langmuir waves and the behavior of the amplitudes of these waves beyond threshold in a beam–plasma system were investigated. The main parameters of the experiments were: plasma density ~10^{11} cm^{-3}, beam current ~100 mA, energy 5 keV, and intensity of constant homogeneous longitudinal magnetic field 1 kG. (M.O.W.)

1248 EXPERIMENTAL INVESTIGATION OF INDUCED SCATTERING OF PLASMA OSCILLATIONS IN A STRONG MAGNETIC FIELD. Izmailov, A. N.; Ivanov, B. I.; Mitin, L. A.; Shapiro, V. D.; Shevchenko, V. I. (Physical-Technical Inst., Kiev). JETP Lett. (USSR) (Engl. Transl.); 12: 51-4(20 Jul 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 73-6 (20 Jul 1970).

The experiments were performed in a one-sided Q machine placed in a homogeneous magnetic field of intensity $H = 2 \times 10^3$ Oe. The plasma oscillations were excited with the aid of a system of coaxial probes, and a movable coaxial probe was used to extract the oscillations. It was observed that the sounding wave becomes amplified along the system in those cases when the pump frequency excited in the plasma has a higher frequency than the sounding wave. If the pump frequency is lower, then the presence of the pump wave in the plasma leads only to an enhancement of the damping of the sounding waves. (M.O.W.)

1249 NONLINEAR INTERACTION OF HF ELECTROMAGNETIC WAVES WITH CYCLOTRON ELECTROSTATIC OSCILLATIONS IN PLASMA. Sholokhov, N. V. (Lebedev Inst. of Physics, Moscow). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 857-63(1970). (In Russian).

HF electromagnetic waves that decay into high-frequency and cyclotron waves $\omega'' \simeq n\Omega_\alpha$ are investigated. It is shown that the ratio of the differential scattering cross sections at the decay through n and n + 1 cyclotron harmonics may be of the order of unity when the wavelength of cyclotron oscillations is less or of the order of the Larmor radius of the plasma particles. A possibility of utilizing the results obtained for weakly turbulent plasma diagnostics is discussed. (tr-auth)

1250 APPLICATION OF WKB METHOD TO THE NONLINEAR WAVE EQUATION AND PROPAGATION OF STRONG ELETROMAGNETIC WAVES IN THE IONOSPHERE. Bass, F. G. (Inst. of Radiophysics and Electronics, Kiev). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 864-72(1970). (In Russian).

The nonlinear propagation of electromagnetic waves in an inhomogeneous medium is investigated, using ionospheric plasma as an example of such a medium. (tr-auth)

1251 INFLUENCE OF COLLISIONS UPON PLASMA WAVE ABSORPTION. Krupina, A. E. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 849-56(1970). (In Russian).

The kinetic equation method is used to investigate the influence of collisions on absorption of plasma waves propagating at an arbitrary angle to the magnetic field. The collision integral is utilized in the form proposed by Bhatnagar, Gross, and Krook. A comparison is made between the relaxation model of the collision integral and BGK model. The cases of strong and weak spatial dispersion are considered. (tr-auth)

1252 INTERACTION OF ION–ACOUSTIC WAVES IN A BEAM–PLASMA SYSTEM. Rabinovich, M. I.; Fainshtein, S. M. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 13: 844-8(1970). (In Russian).

The interaction of ion–acoustic waves at the combinational frequencies in a nonisothermal plasma penetrated by a one-velocity electron beam is considered. It is shown that, in the system investigated, there may occur harmonic generation of ion–acoustic waves and the amplitude restriction of the increasing wave due to the energy pumping of increasing waves into damping waves, i.e., the dynamic stabilization of low-frequency instability. The analysis is made on the basis of quasi-hydrodynamic equations by the averaging method over two variables. (tr-auth)

1253 EXPERIMENTAL OBSERVATION OF NONLINEAR LANDAU DAMPING OF PLASMA WAVES IN A MAGNETIC FIELD. Chang, R. P. H.; Porkolab, M. (Princeton Univ., N. J.). Contract AT(30-1)-1238. Phys. Rev. Lett.; 25: 1262-6(2 Nov 1970).

Experiments on nonlinear Landau damping and growth of longitudinal plasma waves that propagate nearly perpendicular to a magnetic field were carried out. The measured value of the nonlinear wave–particle coupling coefficient is in good agreement with theory. (auth)

1254 PROPAGATION OF SHOCK WAVES IN A CHANNEL IN CASE OF THE INTERACTION OF THE GAS COMPRESSED IN IT WITH A NONHOMOGENEOUS MAGNETIC FIELD. Vatazhin, A. B. Prikl. Mat. Mekh.; 34: 672-84(Jul-Aug 1970). (In Russian).

In earlier studies of the nonstationary flow of conducting gases with shock waves in magnetohydrodynamic channels it has been assumed that the electric current distribution in the gas behind the wave front is uniform and may be controlled by the on-and-off switching of the current in the external circuit connected to the walls of the channel. However, there are always regions in which the magnetic field is nonuniform and the walls are nonconducting; e.g., in the terminal region of the external magnetic field. Behind the shock wave, short-circuit currents are created in the gas. These two-dimensional currents interact with the magnetic field and create perturbations which change the motion of the shock wave. In reviewing the theoretical aspects of the problem, it was attempted to simplify the mathematical complexity by assuming that the magnetohydrodynamic interaction parameter is less than unity and the induced magnetic field does not affect the motion of the plasma. (TTT)

1255 EXPERIMENTAL OBSERVATION OF A NEW SLOW ION WAVE MODE IN A TURBULENT PLASMA. Watanabe, S.; Tanaca, H. (Yokohama National Univ., Japan). Phys. Lett.; 33A: 125-6(5 Oct 1970).

A new mode of ion wave with a slower phase velocity than that of the ion–acoustic wave is observed in a turbulent plasma without magnetic field. (auth)

1256 LOW-FREQUENCY SURFACE WAVES ON A WARM PLASMA. McBride, J. B.; Kaw, P. K. (Princeton Univ., N. J.). Phys. Lett.; 33A: 72-3(5 Oct 1970).

Ion motion is included in analyzing the surface modes of a semi-infinite plasma with warm electrons. It is found that the ions drastically alter the nature of the spectrum for frequencies below the ion plasma frequency. (auth)

1257 ANOMALOUS DAMPING OF LARGE-AMPLITUDE ELECTRON PLASMA OSCILLATIONS. Kruer, W. L.; Dawson, J. M. (Princeton Univ., N. J.). Phys. Rev. Lett.; 25: 1174-6(26 Oct 1970).

The behavior of large-amplitude, high-phase-velocity plasma oscillations in an electron–ion plasma was studied. The experiments show that such a wave, when above a given threshold amplitude, produces an instability that results in its anomalous damping. The results are in agreement with theory. This is one mechanism by which large-amplitude electrostatic oscillations generated by an instability (for example, by the two-stream instability) can be dissipated. (auth)

1258 INTERACTION OF RESONANT ELECTRONS WITH TURBULENT ION–ACOUSTIC OSCILLATIONS. Sizonenko, V. L.; Stepanov, K. N. (Kharkov Inst. of Physics and Tech.). Ukr. Fiz. Zh.; 15: 1116-20(Jul 1970). (In Russian).

Electron motion is considered in the electric field of turbulent ion–acoustic oscillations representing a superposition of three-dimensional wave packets with chaotic phases. It is shown that during the time interval $\Delta t \sim (1/\omega_{pe})[(nT_e/W)]^{1/2}$, the phase shift between a resonant wave and a particle reaches the value of π, the velocity excess got by a particle being $\Delta\xi \sim v_{T_e}[(W/nt_e)]^{1/2}$ and the particle shifts at a distance of $\Delta\xi \sim (1/\bar{k}) \sim r_D$. Here ω_{pe}, T_e, n are plasma frequency, temperature, and density of electrons, respectively; $v_{T_e} = [(W/nT_e)]^{1/2}$, r_D is the Debye radius, W is energy density of ion–acoustic oscillations. The frequency of particles being removed out from the resonance is $\nu \sim (1/\Delta t)$. This frequency determines the "broadening" of resonant denominators $(\omega - \bar{k}\bar{v})^{-1}$ of a perturbation theory series in the theory of weak turbulence. (auth)

Shielding

Refer also to abstracts 1530 and 1967.

1259 SIMULATING ENERGY AND ANGLE DISTRIBUTIONS ABOVE INFINITE PLANE ^{60}Co SOURCES. Burson, Z. G. (EG and G, Las Vegas); French, R. L. Health Phys.; 18: 507-21(May 1970).

A combination of a disc and a ring source of appropriate radii can be used to produce gamma-ray energy and angle distributions equivalent to those above an infinite plane, thus avoiding the "far-out" correction usually required for shielding experiments performed in a simulated fallout field. Examination of angle distribution data measured 3 ft above plane ^{60}Co sources led to this concept. Monte Carlo calculations of both the energy and the angular distributions 3 and 40 ft above disc, ring, and infinite plane sources substantiate this concept. The degree of simulation is somewhat insensitive to the exact radius of the ring source; large deviations in ring-source radii can be tolerated without severe penalty in some shielding studies. (auth) (UK)

Solid-State Physics

Radiation Effects

Refer also to abstracts 387 and 962.

1260 (COO-1198-744) ELECTRON IRRADIATION EFFECTS IN SILICON AT LIQUID HELIUM TEMPERATURES USING AC HOPPING CONDUCTIVITY. McKeighen, R. E.; Koehler, J. S. (Illinois Univ., Urbana). Aug 1970. Contract AT(11-1)-1198. 16p. (CONF-700824-1). Dep. NTIS.

From International Conference on Radiation Effects and Semiconductors, Albany, N. Y.

Changes in ac hopping conductivity with electron irradiation were measured in n-type, p-type, and high purity silicon. Irradiations were carried out at both 4.8 and 1.6°K, with measurements made at reference temperatures of 4.2 and 1.3°K, respectively. In the p-type crystals, the changes in ac hopping conductivity depended strongly on the concentration of chemical acceptors, indicating a concentration dependence on impurities in the defect production rate. The production rates at 1.6°K were generally very similar to those for a 4.8°K irradiation. No significant thermal annealing stages below room temperature were observed in any of the crystals. A small amount of "reverse annealing," i.e., an increase in ac hopping conductivity, was observed below 30°K. No radiation annealing effects due to a beam of either 0.500- or 0.350-MeV electrons were observed, either at 4.5 or at 1.45°K. (auth)

1261 (NP-18472) EVOLUTION OF THE CARRIER LIFETIME IN JUNCTION DIODES IRRADIATED BY HIGH-ENERGY PROTONS. Bielle, Jean (Toulouse Univ. (France). Faculte des Sciences). 1970. 186p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis.

The effects of 5.5 to 3,000-MeV proton and 4.5-MeV electron irradiations on carrier lifetimes were studied with different types of junction diodes and solar cells. The carrier lifetime evolution was analyzed as a function of the technological characteristics of the devices, the silicon properties, the carrier injection rate, and the nature of the radioinduced defects. A new equivalence concept relative to lifetime degradation allows one to characterize the effects of different nuclear particles from the structure of the defects. (tr-auth) (France)

1262 (NP-18474) EFFECTS OF VERY-HIGH-ENERGY PROTONS ON ELECTRIC PROPERTIES OF SILICON AND GERMANIUM. Bielle-Daspet, Danielle (Toulouse Univ. (France). Faculte des Sciences). 2 Mar 1970. 244p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis.

The effects of high-energy protons (270, 590, and 3000 MeV) on the density, mobility, and lifetimes of carriers, in samples of n- and p-silicon and germanium, were studied at different temperatures. The degradations observed were between 50 and 100 times as important as those produced by irradiation with 4.5-MeV electrons. The existence of a particular type of perturbed zone, produced by the protons, was proved; this zone is defined by a very important region and a relatively low density of displaced atoms. This defect is introduced simultaneously with the dense clusters in the germanium and is the only phenomenon dominating the observed degradation for the case of silicon. Its diffuse character is particularly accentuated in silicon. Two kinds of defects occur simultaneously within this defect: point defects and cluster-type defects. The system exhibits characteristics that are due to both types of defect. (France)

1263 COLOR CENTER STUDIES IN CERTAIN ALKALI SULFATE CRYSTALS. PART I. OPTICAL ABSORPTION IN IRRADIATED SODIUM SULFATE. Hariharan, N.; Sobhanadri, J. (Indian Inst. of Tech., Madras). Indian J. Pure Appl. Phys.; 6: 73-4(Mar 1968).

The optical absorption of x-irradiated Na_2SO_4 single crystals was studied in the visible and ultraviolet regions. Four absorption peaks were observed at 226, 263, 329, and 476 mμ. The tentative analysis proposed indicates the presence of SO_3^-, SO_2^-, and colloidal sulfur as products of radiolysis corresponding to the absorption peaks at 226, 329, and 263 mμ respectively. (auth)

1264 SOME ANNEALING CHARACTERISTICS OF HEAVY ION TRACKS IN SILICATE MINERALS. Maurette, M. (Washington Univ., St. Louis). Contracts NAS 9-8165; Z80058T. Radiat. Eff.; 5: 15-19(Aug 1970).

The thermal annealing of fossil tracks stored in hypersthene crystals of the Johnstown meteorite was studied. It was observed that the annealing of the tracks depends on their initial length and therefore on the charge of the incident ions. The shortest tracks are annealed at a lower temperature than the longer ones. These long tracks in turn were found to be less thermally stable, on the average, than fission-fragment tracks. After some difficulties in the study of the annealing of heavy ion tracks in solids are pointed out, the possibility of using thermal annealing to identify the origins of the tracks stored in naturally or artificially irradiated silicate minerals is discussed. (auth)

1265 ANGULAR AND TEMPERATURE DEPENDENCE OF SECONDARY EMISSION OF InSb SINGLE CRYSTALS BOMBARDED BY ARGON IONS. Kapusta, O. I.; Lebedev, S. Ya.; Omel'yanovskaya, N. M. Sov. Phys.-Solid State (Engl. Transl.); 12: 781-5(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 995-1000(Apr 1970).

Ion–electron and ion–ion emission is studied as a function of target temperature and of the angle of incidence of 70-keV argon ions on the {111} and {110} faces of InSb single crystals; the dependence of ion–electron emission coefficients on the energy of bombarding ions is also determined at normal incidence. It is shown that at sufficiently high target temperatures, the results obtained agree qualitatively with the transparency model provided that the displacement of atoms in the surface layers of the crystal is taken into account. It was observed that the temperature variation of the ion–electron emission coefficient has five distinct regions whose existence is associated both with the annealing of radiation defects and with changes taking place in an amorphous film present on the crystal surface. (auth)

1266 CONCENTRATION PROFILE OF BORON IONS IMPLANTED INTO SILICON WITH ENERGIES OF 30 AND 100 keV. Pistryak, V. M.; Gnap, A. K.; Kozlov, V. F.; (and others) (Physical-Technical Inst., Kharkov). Sov. Phys.-Solid State (Engl. Transl.); 12: 1005-6(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1281-3(Apr 1970).

A secondary ion–ion emission method was used to determine the distribution of B ions implanted into Si single crystals with (111) and (110) orientations at 30 and 100 keV. A primary 13-keV Ar^+ ion beam was used to sputter off layers of the doped Si; the resulting secondary B^+ ions were detected. For an ion dose of 10^{16} ions/cm^2, the profiles have maxima at 0.3 μ (30 keV) and 0.43 μ (100 keV) for the (111) plane and 0.33 μ (30 keV) and 0.49 μ (100 keV) for the (110) plane; these values are greater than predictions for amorphous targets. This and the difference between (111) and (110) planes are ascribed to channeling. (D.L.C.)

1267 DIFFUSION OF INDIUM AND ANTIMONY IN GERMANIUM IRRADIATED WITH LOW-ENERGY ELECTRONS. Dudko, G. V.; Marunina, N. I.; Sukhov, G. V.; Cherednichenko, D. I. (Taranrog Radiotechnical Inst., USSR). Sov. Phys.-Solid State (Engl. Transl.); 12: 1016-18(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1292-4(Apr 1970).

The diffusion of In and Sb in Ge oriented in the (111) plane and irradiated with electrons of low energy (<30 keV) was studied using radioisotopes in the temperature range 650 to 850°C. The dislocation density at the surface was determined to be 5×10^6 to 5×10^7 cm^{-2}. The diffusion parameters were found to be $D_0 = 5.8 \times 10^3$ cm^2/sec and Q = 57,000 cal/mole for In, and $D_0 = 21$ cm^2/sec and Q = 48,000 cal/mole for Sb. The occurrence of accelerated diffusion along dislocations was verified in a p–n junction. This effect is probably associated with the development of a dislocation network. The time required for reaching equilibrium of vacancies from diffusion and coagulation at dislocations is considered. (D.L.C.)

1268 SUBTHRESHOLD IRRADIATION EFFECTS IN SILICON EPITAXIAL FILMS. Zaikovskaya, M. A.; Kiv, A. E.; Niyazova, O. R. (Inst. of Nuclear Physics, Tashkent). Phys. Status Solidi (a); 3: 99-104(16 Sep 1970).

Radioinduced changes in the electrical resistance ($\Delta R/R_0$) of

silicon epitaxial films subjected to bombardment with electrons of energies up to 100 keV were studied. The investigated effects (dose, energy, and other dependences) on epitaxial layers of various thickness give new information on the subthreshold mechanism of damage production and the passage of low-energy electrons through semiconductors. (auth)

1269 EFFECT OF THERMAL OSCILLATIONS OF LATTICE ATOMS ON ANGULAR AND ENERGY DISTRIBUTIONS OF IONS SCATTERED BY A SINGLE CRYSTAL. Arifov, U. A.; Aliev, A. A. (Inst. of Electronics, Tashkent). Dokl. Akad. Nauk SSSR; 192: 1244-7(21 Jun 1970). (In Russian).

Experiments were carried out to determine the angular distribution in the interactions of ions with refractory-metal (tungsten and molybdenum) single crystals in the low-energy range of $E_0 <$ 5000 eV, in order to determine the influence of the crystal structure on the angular and energy distribution of secondary ions in a wide temperature range. The angle of incidence of the bombarding particles was varied by using a mobile Rb^+ ion source. The previously observed anisotropy of ion scattering coefficients was noted again; however, the temperature-induced smoothing of the coefficient was not found; this is probably due to the fact that the amplitude of the thermal oscillations of lattice ions affects strongly the transparency of the crystals. The diffused ions also exhibit anisotropy but the maximum coincided with the minimum of the scattering coefficients and vice versa. Ion scattering and refraction techniques may be used to study the structure of solids by correlating the oscillations of lattice atoms. (TTT)

1270 "CHAIN EFFECT" IN THE SCATTERING OF IONS BY THE FACE OF A SINGLE CRYSTAL. Kivilis, V. M.; Parilis, E. S.; Turaev, N. Yu. (Inst. of Electronics, Tashkent). Dokl. Akad. Nauk SSSR; 192: 1259-62(21 Jun 1970). (In Russian).

It was found earlier that successive scatterings of ions on atoms lying in the closely packed axis of the crystal creates as so-called "chain effect" which is discernible in the specific angular and energy distribution of the scattering. In order to further clarify the meaning of previous observations, the energy dependence E of the ions reflected at various scattering angles θ, the initial ion energies, and crystal temperatures were calculated using data obtained with Ar^+ ions scattered by the [110] chain of Cu. The initial energies used were 5, 10, and 30 keV; the angles chosen were 10, 12, 14, 15, 18, 20, and 24° while the temperature was $T = 0$ and $T = T_1$, i.e. the temperature of the ideal immobile lattice and an atomic oscillation amplitude of 0.1 d, where d = the interatomic distance. The results indicated that transition to ordinary scattering is accomplished (1) by increasing the angle at the same energy and temperature, (2) increasing the temperature to T_1, and (3) increasing the energy E_0. Discrepancies between experimental and theoretical data may be due to differences in the temperature; the experiments were carried out at T = 300°K. (TTT)

1271 THERMOLUMINESCENCE OF CALCITE INDUCED BY ALPHA AND REACTOR RADIATIONS. Luthra, J. M.; Gupta, N. M. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Pure Appl. Phys.; 7: 287-8(Apr 1969).

Thermoluminescence emission above room temperature of pile-irradiated and α-bombarded natural calcite from "Bagalkot" mines of India has been studied. The glow curves of pile- and α-irradiated crystals give peaks at 150, 230, 270, and 320°C. The 230°C thermoluminescence peak is induced by corpuscular radiations only and not by ionizing radiations. The corpuscular radiations produce atomic displacements which get converted into traps by capturing electrons or holes created by ionizing radiations. These new traps are responsible for the peak at 230°C in the glow curve. The 150°C peak decays completely at room temperature in the samples irradiated by ionizing radiations, while in the pile-irradiated sample it could be observed after the lapse of a considerable time. This difference in decay behavior is attributed to the continuous internal bombardment by ionizing radiations emitted by radioactive atoms formed in the crystal by neutron irradiation. (auth)

1272 COLOR CENTER STUDIES IN CERTAIN ALKALI SULFATE CRYSTALS. II. PARAMAGNETIC CENTERS IN IRRADIATED SODIUM SULFATE AT 77°K. Hariharan, N.; Sobhanadri, J. (Indian Inst. of Tech., Madras). Indian J. Pure Appl. Phys.; 7: 240-2(Apr 1969).

Paramagnetic centers in x-ray irradiated sodium sulfate were identified by ESR measurements at 77°K in polycrystalline and single crystal samples. The ESR spectra of single crystals of Na_2SO_4 irradiated at room temperature and examined at 77°K showed the presence of two species, A and B, characterized by intense isotropic lines, and a third species, C, characterized by a relatively weaker anisotropic spectra. The powder of the irradiated crystal also showed identical spectra confirming that the radicals A and B are characteristic of isotropic spectra and an average line for the anisotropic spectra of radical C. From a comparison with the optical absorption results, the radicals have been identified as SO_4^-, SO_3^-, and O_3^- respectively. (auth)

1273 DEUTERON AND HELIUM ION CHANNELING IN URANIUM CARBIDE. Matzke, Hj. (European Inst. for Transuranium Elements, Karlsruhe, Ger.). J. Mater. Sci.; 5: 777-83 (Sep 1970).

The channeling of 1-MeV He^+ ions, of 400-keV protons, and of deuterons of energies between 1.0 and 1.25 MeV in UC single crystals was studied. Wide-angle scattering off uranium atoms and the nuclear reaction C-12 (d,p) C-13 were used to investigate the interaction of the ion beam with uranium and carbon atoms separately. The observed critical angles for channeling along the ⟨100⟩ axis are about 25% smaller than the theoretical predictions for ψ_1. However, when considering the influence of lattice vibrations, agreement with theory is achieved. (auth) (UK)

1274 CERTAIN PROPERTIES OF PHOTOCONDUCTIVITY SPECTRA FOR P-TYPE Si IRRADIATED WITH FAST ELECTRONS. Akimchenko, I. P.; Vavilov, V. S.; Plotnikov, A. F. (Inst. of Physics, Moscow). Fiz. Tekh. Poluprov.; 4: 1020-3 (Jun 1970). (In Russian).

Photoconductivity spectra of electron-irradiated p-type Si crystals containing oxygen were studied. It is shown that the minimum at $\lambda = 1.26\ \mu$ observed at 100°K and at high-intensity incident radiation is related to the optical center recharge of the contributing levels $E_v + 0.16$ and $E_v = 0.29$ eV. A possible application of the observed effect is for converting infrared radiation into television images. (tr-auth)

1275 STUDIES OF γ-RADIATION DEFECTS IN HIGH-PURITY GERMANIUM. Vitovskii, N. A.; Maksimov, M.; Mashovets, T. V. (Inst. of Physics, Leningrad). Fiz. Tekh. Poluprov.; 4: 1030-8(Jun 1970). (In Russian).

Studies of the formation and annealing of ^{60}Co γ-ray-induced defects (1×10^{12} quanta/cm^2 · sec at 8°C) in pure Ge showed that, in n–Ge, the principal process consisted of connecting the vacancies with the atoms of the group V elements. Following the n–p conversion, in which all the group V atoms are bound, the efficiency of vacancy binding in the divacancies and binding of vacancies with the atoms of other impurities were increased considerably. (tr-auth)

1276 NEUTRON RADIATION EFFECTS ON THE GaAs REFLECTION FACTOR. Baramidze, N. V.; Kurdiani, N. I. Fiz. Tekh. Poluprov.; 4: 1194-5(Jun 1970). (In Russian).

Neutron radiation effects on the zonal structure in semiconductors were studied, considering electron transitions not only in the center of Brillouin zone but also at large magnitudes of the wave vector. The transitions were studied by measuring coefficients of reflections in the visual and ultraviolet region. Specimens of relatively pure p-type GaAs with the vacancy concentration of 2.3×10^{16} cm and mobility $\mu = 193$ cm^2/v · sec, as well as compensated specimens with $\rho \sim 10^6$ ohm/cm were irradiated by fast neutrons (1×10^{17}, 5×10^{17}, 1×10^{18}, and 2.4×10^{18} n/cm^2 at room temperature). Annealing of the p-type specimens irradiated with 2.4×10^{18} n/cm^2 doses resulted in complete coincidence of the spectral distribution of reflection coefficient for specimens before irradiation and after annealing. The results of annealing, and the fact that in pure GaAs crystals and in compensated specimens the changes of spectra are identical, indicate that the contractions of the forbidden zone in irradiated GaAs are the result of radioinduced defects rather than the defects caused by impurities. (R.V.J.)

1277 IRRADIATION OF ARTIFICIAL DIAMONDS BY FAST ELECTRONS. Gerasimenko, N. N.; Lezheiko, L. V.; Litvin, Yu. A.; Smirnov, L. S. (Inst. of Physics of Semiconductors, Novosibirsk, USSR). Fiz. Tekh. Poluprov.; 4: 1064-8(Jun 1970). (In Russian).

Irradiation with 3.5-MeV electrons (5×10^{16} to 10^{17} el./cm^2 doses) at 800°C followed by thermal treatment changed the luminescence spectra in artificial diamonds alloyed by various elements in the interval 3,000 to 10,000 Å. Spectra of crystals with various alloying elements became similar to luminescence spectra of irradiated and annealed natural diamond crystals. The resistance of semiconductors increased after irradiation, depending on the quantity of impurities. Thermal treatment at 800°C following the irradiation amplified luminescence spectrum changes appearing during irradiation, but it also eliminated considerably the variations in resistance. It was postulated that the observed luminescence variations are the result of the formation of stable complexes with the participation of nitrogen and that the variation of resistance is the result of introduced elementary defects or unstable complexes. (R.V.J.)

XUM

1278 DISTRIBUTION OF CONDUCTIVITY IN DEPTH IN DIAMOND ALLOYED BY BOMBARDMENT WITH ^7Li IONS AT ENERGIES 10 TO 45 keV. Vavilov, V. S.; Galkin, V. V.; Krasnopevtsev, V. V.; Milyutin, Yu. V. (Inst. of Physics, Moscow). Fiz. Tekh. Poluprov.; 4: 1180-2(Jun 1970). (In Russian).

Studies were made of total conductivity in the depths of semiconductor layers of diamonds alloyed by means of bombardment with ^7Li ions at 10 to 45 keV. Experiments were carried out at room temperature using 0.2- to 0.6-mm thick natural diamonds. A semilogarithmic coordinate was obtained for the total conductivity Σ, reduced to the maximum magnitude, as a function of the thickness of diamond layers for diamonds alloyed by ^7Li ions at 35 keV and 0.5×10^{16} ion/cm^2 doses. (R.V.J.)

1279 OPTICAL ABSORPTION AND THERMOLUMINESCENCE OF MANGANESE-DOPED CaF_2 SINGLE CRYSTALS IRRADIATED WITH X RAYS. Agrawal, M. D.; Rao, K. V. (Indian Inst. of Tech., Kharagpur). Phys. Status Solidi (a); 3: 153-9(16 Sep 1970).

Optical absorption in the region 220 to 800 nm and thermoluminescence of x-irradiated CaF_2 single crystals were measured. Similar measurements were also taken on manganese-doped CaF_2 crystals (with 0.2, 1, and 5 mol% of manganese content). The thermal bleaching characteristics of color centers in CaF_2: Mn samples have been investigated. Two features are observed in manganese-doped CaF_2 crystals after x-ray irradiation (in comparison to x-ray-irradiated CaF_2): (i) an enhancement of colorability with increasing Mn content and (ii) formation of α- and β-bands in CaF_2: Mn (1%) and also new absorption bands in CaF_2: Mn(5%). A new absorption band at 300 nm obtained in the x-ray-irradiated CaF_2: Mn (5%) may probably be connected with Mn^0 centers. The thermoluminescence of CaF_2 is considerably affected with manganese doping. An attempt was made to understand these results. (auth)

1280 INTERNATIONAL CONFERENCE ON NONMETALLIC CRYSTALS HELD IN NEW DELHI, INDIA, JANUARY, 1969. Chadderton, Lewis T. (ed.). Radiat. Eff.; 4: 1-336(Jul 1970). (CONF-690126).

In these two double issues, fifty-six papers are included that treat topics closely related to radiation effects in solids. These topics are: electrical and optical properties, semiconductors and their doping, defects, transport and diffusion, ionic crystals, thermoluminescence, physical properties, crystal structure, and radiation damage. Separate abstracts were prepared for 13 of the papers. (D.L.C.)

For abstracts of individual papers see: 106, 448, 482, 758, 1281–1288, and 1327.

1281 MANGANESE CENTERS WITH VARIOUS VALENCY IN ALKALI HALIDES. Itoh, Noriaki; Ikeya, Motoji (Nagoya Univ., Japan). Radiat. Eff.; 4: 161-5(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Optical absorption bands and EPR spectra of NaCl: Mn^{2+} x-irradiated at liquid nitrogen and room temperature are studied. Manganese EPR spectra are divided into three classes, based on the value of hyperfine splitting constants. It is shown that the EPR spectra with the hyperfine splitting constants of around 250×10^{-4}, 80×10^{-4}, and 20×10^{-4} cm^{-1} are caused by Mn^+, Mn^{2+}, and Mn^0, respectively. Formation of several manganese centers by x irradiation is discussed. It is suggested that optical absorption bands at 410 and 440 nm are caused by Mn^0 at the lattice site and that the Mn^0 center which gives an EPR spectrum with $A = 15.5 \times 10^{-4}$ cm^{-1} is associated with a Mn^0 center which is not at a substitutional site. (auth)

1282 EARLY-STAGE F COLORATION IN LITHIUM FLUORIDE DOPED WITH DIVALENT CATION IMPURITIES. Berge, P.; Dubois, M.; Laj, C. (CEN de Saclay, Gif-sur-Yvette, France). Radiat. Eff.; 4: 173-5(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Using γ-ray irradiation at different temperatures and fluxes, new information on the early-stage F coloration of LiF is obtained that can be easily interpreted in terms of the Crawford mechanism. (auth)

1283 OPTICAL AND ESR STUDIES IN PURE AND Mn-DOPED LiF CRYSTALS. Mehendru, P. C.; Sootha, G. D.; Mitra, Ved (National Physical Lab., New Delhi). Radiat. Eff.; 4: 179-83(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Growth of F absorption band with the time of x irradiation at room temperature and the changes caused in the F absorption as a function of F light and thermal bleaching along with simultaneous ESR studies in pure and Mn-doped LiF single crystals are reported. (auth)

1284 EFFECTS OF LATTICE DEFECTS ON THERMOLUMINESCENCE IN LITHIUM FLUORIDE CRYSTALS. Stoebe, T. G.; Guilmet, G. M.; Lee, J. K. (Univ. of Washington, Seattle). Radiat. Eff.; 4: 189-93(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

The thermoluminescent output of "pure" LiF single crystals is studied as a function of annealing temperature and cooling rate. The lattice defect structure is characterized using ionic conductivity measurements. The results show that the sensitivity of such crystals to irradiation is highly dependent on prior history; specifically, the intensity of the observed 105°C thermoluminescence peak depends directly on the concentration of impurity vacancy pairs present. The results also show the importance of background impurities in effecting thermoluminescent sensitivity. (auth)

1285 EPR AND OPTICAL ABSORPTION STUDIES OF X-IRRADIATED COBALT-DOPED SODIUM CHLORIDE CRYSTALS. Jain, S. C.; Lal, Krishan (National Physical Lab., New Delhi). Radiat. Eff.; 4: 219-22(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Sodium chloride crystals containing small concentrations of cobalt ($\leq$ 10 ppm) do not show any EPR line. A thick block of crystal containing ~25 ppm of Co showed two partially resolved lines, with approximate g values 2.036 and 2.011. These g values are not close to those of Co^{2+} (4.0 to 4.5) in other crystals. On x irradiation, pure NaCl crystals show a complex EPR spectrum. X-irradiated Co-doped NaCl crystals showed an EPR line superimposed on the complex EPR spectrum. Cobalt-doped highly pure crystals, on x irradiation, showed an EPR line superimposed on the F-center EPR line. The g value of the former is 2.049 ± 0.002 and half width is 62 ± 3 gauss. These results combined with those of dielectric loss and optical studies show that x-irradiation of Co-doped crystals produces new centers, labeled as S centers, which produce a dielectric loss peak, a decrease in electrical conductivity, an optical band at 210 nm, and the EPR line. Possible models of the S centers are discussed. (auth)

1286 POINT DEFECTS IN ALKALINE EARTH FLUORIDES. Hayes, W. (Oxford Univ.). Radiat. Eff.; 4: 239-46(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Intrinsic electron and hole traps in alkaline earth fluorides are described. F centers were investigated in these crystals by ENDOR and magneto-optical methods and the results compared with the predictions of point ion wave functions. The optical properties of M centers were established, and preliminary work on the optical properties of higher F-aggregate centers is described. Both the EPR and optical properties of the self-trapped holes were extensively investigated and are described. (auth)

1287 ANALYSIS OF RADIATION DAMAGE IN SILICON BY THERMAL ANNEALING OF SOLAR CELLS. Faraday, Bruce J. (Naval Research Lab., Washington, D. C.). Radiat. Eff.; 4: 293-301(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

Thermal annealing of the photovoltaic parameters of silicon solar cells irradiated at room temperature by electrons (15 to 45 MeV), protons (5 MeV), and fast neutrons was studied up to a temperature of 500°C. The cells were prepared from single crystals grown by the Czochralski process (oxygen ~ 10^{18}/cm^3) by the floating-zone technique (oxygen ~ 10^{16}/cm^3), each doped with boron or aluminum. The radiation damage was observed to anneal in two characteristic stages. The first stage occurs between 50 and 200°C and is independent of dopant type, of dopant concentration, and of the concentration of oxygen impurity. It is suggested that this stage is due to the breaking-up of clusters of recombination centers. In the second stage, observed between 275 and 450°C, the remaining damage produced by bombardment is removed. Unlike the low-temperature stage, it is strongly dependent on the nature of the dopant and oxygen impurity concentration and bears a close resemblance to the annealing of 1-MeV electron radiation damage. Thus, it is proposed that the latter stage is due to the annealing of damage from point defects and complexes between these and dopant and oxygen atoms. (auth)

1288 RECENT DEVELOPMENTS OF THERMOLUMINESCENCE STUDIES IN ALKALI HALIDE CRYSTALS: PHOTOSTIMULATED THERMOLUMINESCENCE. Fieschi, R.; Paracchini, C. (Univ., Parma, Italy). Radiat. Eff.; 4: 319-35(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

The processes inherent to thermoluminescence phenomena and the information yielded by thermoluminescence measurements on a real crystal are described. A brief review of the results in alkali halides is presented. The method of photostimulated thermoluminescence is presented with a summary of the typical results obtained by the authors: a sample is previously x-irradiated at a high temperature; next, trap filling is obtained by illumination with monochromatic light; the sample is then heated and the glow curve recorded. The process bears some analogy to photoconductivity, with higher sensitivity; moreover, it allows the separation of the electron from the hole contribution and evidences different mechanisms of trap filling. A recent development of the method is shown, namely the study of photostimulated thermoluminescence in additively colored alkali halide crystals. (auth)

1289 HALL EFFECT ANISOTROPY IN γ-IRRADIATED n-Ge WITH OXYGEN IMPURITY. Baranskii, P. I.; Gaiduchenko, V. V.; Shershel, V. A. (Kiev Inst. of Semiconductors). Ukr. Fiz. Zh.; 15: 1194-7(Jul 1970). (In Russian).

By measuring the field dependence of the Hall effect in a wide range up to 35 kOe, the Hall effect anisotropy was investigated at 77°K on γ-irradiated (^{60}Co) and non-irradiated n-Ge samples with oxygen impurity in different states in initial crystals and in those annealed at low temperatures (at 400°C for 100 hr). It was shown that the change in scattering anisotropy under the effect of γ irradiation depends on the state of oxygen impurity in Ge. Conditions were also found for which the carrier mobility μ influenced by γ irradiation does not decrease (as usually), but increases. (auth)

1290 LATTICE DISORDER PRODUCED IN GaAs BY 60-keV Cd IONS AND 70-keV Zn IONS. Westmoreland, J. E. (California Inst. of Tech., Pasadena); Marsh, O. J.; Hunsperger, R. G. Radiat. Eff.; 5: 245-9(Oct 1970).

The standard channeling technique with a 1.0-MeV He^+ analyzing beam was used to investigate the lattice disorder produced in GaAs by 60-keV Cd and 70-keV Zn ion implantations made at room temperature. The amount of disorder produced increases linearly with dose and saturates at a dose of approximately $1-2\times10^{13}$Cd ions/cm^2. The disorder present in low-dose implants ($\sim5\times10^{12}$ Cd ions/cm^2) anneals appreciably by 150°C. With increasing doses of Cd or Zn, the samples show a continuous increase in the anneal temperature required to remove a substantial amount of lattice disorder. There is no apparent difference between the anneal of Zn and Cd implants. The rate at which lattice disorder is produced in GaAs by heavy ion implantations and the doses of heavy ions required to saturate the lattice disorder observed are significantly different from the values of the corresponding quantities for Si and Ge. (auth)

1291 DEFECTS RESPONSIBLE FOR ELECTRICAL PROPERTY CHANGES IN IRRADIATED OXIDES. Alecu, I. D.; Cojocaru, L. N. (Inst. for Atomic Physics, Bucharest). Radiat. Eff.; 5: 251-4(Oct 1970).

A comparison is made between the activation energies for post-irradiation thermal recovery of electrical properties of NiO, Cr_2O_3, and UO_2-SiO_2 which were determined from previously published data, and the activation energies found in the literature for volume diffusion of the component atoms. It is shown that oxygen vacancies are most probably responsible for radioinduced changes in electrical properties of NiO and Cr_2O_3. Oxygen defects contribute also to the changes in electrical properties observed in UO_2-SiO_2. (auth)

1292 INFLUENCE OF TRAPPING AT IMPURITY ATOMS ON DIFFUSION ANNEALING OF METALS AFTER ELECTRON IRRADIATION. Schroeder, K. (Univ. of Illinois, Urbana). Contract AT(11-1)-1198. Radiat. Eff.; 5: 255-63(Oct 1970).

A theory of correlated diffusion annealing is presented that takes into account the trapping of mobile interstitials at impurity atoms. Both the cases of three-dimensional diffusion and one-dimensional crowdion diffusion are considered. In the case of three-dimensional diffusion, the trapping can be approximately described by a "trapping constant" in the diffusion equation of the interstitial. To derive this description from the general equations, the superposition approximation is used, in which third-order correlations are replaced by products of second-order correlations. Comparison with experimental data of Sosin and Neely on Au atoms in Cu seems to support the picture of three-dimensional diffusion and yields a trapping volume around Au atoms in Cu of about 90 atomic volumes. But from the few data points available, no definite conclusions can be drawn concerning the nature of interstitial migration at low temperature. (auth)

1293 DAMAGE RATES AND RECOVERY IN ELECTRON-IRRADIATED Au-Ag ALLOYS. Sprusil, B.; Haas, H.; Wollenberger, H. (Kernforschungsanlage, Juelich, Ger. Technische Hochschule, Aachen). Radiat. Eff.; 5: 273-5(Oct 1970).

Annealed foils of Au alloys containing 0.2, 5.0, and 15 at. % Ag were irradiated by 3-MeV electrons in a cryostat, and the electrical resistivity then measured at 4.2°K. The radioinduced resistivity increase vs electron dose graph yields linear damage rates $d\rho/d\phi$ of 2.0×10^{-26}, 2.9×10^{-26}, and $3.5\times10^{-26}\ \Omega\cdot cm^3$ for the 0.2, 5.0, and 15 at. % alloys, respectively. Isochronal annealing curves show that the resistivity change anneals out in two stages above 250°K for the 0.2 and 5.0 at. % alloys; the 15 at. % alloy exhibits an unusual peak at 320°K, probably due to increasing short-range order. (D.L.C.)

1294 COMPUTER SIMULATION AND CLASSICAL INTERPRETATION OF FAST ION EMISSION PROFILES NEAR PLANES. Morgan, D. Vernon (Atomic Energy Research Establishment, Harwell, Eng.); Van Vliet, D. Radiat. Eff.; 5: 157-71(Oct 1970).

The techniques of computer simulation are used to generate the velocity distribution of ions emerging near close packed planes from a crystal surface. Emphasis is placed on protons and α particles, 5 to 100 keV, near (100) planes in copper. The ions are initially emitted from either a lattice site—the "blocking case"—or any other given point within a unit cell—"intermediate emission." The resultant profiles are compared with an analytic model due to Andersen based on the continuum approximation, and the validity of this model is thereby assessed. A simpler analytic model in which the interplanar continuum potential is approximated by a pure harmonic is also developed and compared with the previous two. Using the harmonic approximation, we obtain a relatively simple relationship between the yield measured exactly parallel to a plane and the position of the original emission site. It is suggested that such a relationship could be of importance for experiments that can measure nuclear lifetimes of the order of 10^{-16} to 10^{-15} seconds. (auth)

1295 DIFFRACTION DEPENDENCE OF ELECTRON DAMAGE IN A HIGH-VOLTAGE ELECTRON MICROSCOPE. Thomas, L. E. (United States Steel Corp., Monroeville, Pa.). Radiat. Eff.; 5: 183-94(Oct 1970).

In a high-voltage electron microscope the intense electron beam used for imaging can cause visible aggregates of point defects to form in metals in just a few minutes. The diffraction-dependence of the defect cluster production was studied experimentally in Cu and Fe using a 1000-kV electron microscope. Also, a simple method for calculating the diffraction-dependence of the atomic displacement rate was devised from multiple-beam wave-mechanical diffraction theory. The calculations indicate that the rate of point defect production should vary at most by a factor of ~1.7 with Bragg deviation in systematic diffraction cases, and that this variation should decrease rapidly with increasing depth in the crystal. The experimental observations are consistent with these predictions. In addition, the theory allows the diffraction-dependence of the displacement rate to be explained in terms of Bloch wave properties. Some new observations of the defect structures in electron-irradiated Cu and Fe are also described. (auth)

1296 VERIFICATION OF QUANTUM EFFECTS IN THE SCATTERING OF HEAVY CHARGED PARTICLES BY SINGLE CRYSTALS. De Wames, R. E.; Chadderton, L. T.; Cohen, E. R. (North American Rockwell Corp., Thousand Oaks, Calif.). Radiat. Eff.; 5: 195-6(Oct 1970).

An isotopic effect recently reported by Foti and coworkers in Rutherford scattering from a silicon single crystal is ascribed to the quantum mechanical near-field effects of a positive potential. An experiment further to verify this interpretation is proposed. (auth)

1297 QUANTUM EFFECTS IN RUTHERFORD BACKSCATTERING AND EMISSION OF ELECTRONS NEAR A CRYSTAL AXIS. De Wames, R. E.; Hall, W. F. (North American Rockwell Corp., Thousand Oaks, Calif.). Radiat. Eff.; 5: 197-201 (Oct 1970).

By increasing the strength of the interaction potential for a reasonable range of values, it is shown that the angular pattern of the electron intensity, about a crystallographic axis, changes from one dominated by Bragg peaks to an essentially structureless curve. This retains a significant dependence on h, and by that token cannot be identified with the "classical envelope." (auth)

1298 MICRORELIEF ON ION-BOMBARDED CRYSTALS AND INDUCED DAMAGE. Hermanne, N.; Art, A. (Univ. Libre, Brussels). Radiat. Eff.; 5: 203-11(Oct 1970).

Two types of bombardment experiments were performed: a first series on metallic spheres, examined by replicas, and a second series on thinned crystals, examined by transmission electron microscopy. A model for the formation of the surface microrelief is proposed from the observations. This model enables one to correlate the observation of regular dislocation networks, due to the segregation in perfect loops of the induced point defects, to the formation of the relief structure by a preferential sputtering mechanism. (auth)

1299 COLOR CENTERS CREATED IN LiF AND NaCl BY 2-MeV Li^+ BEAMS AND 0.8-MeV Na^+ BEAMS. Perez, Alain; Thevenard, Paul; Dupuy, Claude H. S. (Lyon Univ., Villeurbanne, France). Compt. Rend., Ser. B: 271: 519-22(7 Sep 1970). (In French).

A strong coloration appears in crystals of LiF and NaCl bombarded by Li^+ and Na^+ ions. One of the absorption bands can be related to metal colloids. (tr-auth) (France)

1300 CHANGE IN α-PLUTONIUM ELECTRICAL-RESISTIVITY DURING NEUTRON IRRADIATION IN LIQUID NITROGEN. Konobeevskii, S. T.; Raetskii, V. M.; Kosulin, N. S. At. Energ. (USSR); 29: 80-2(Aug 1970). (In Russian).

The resistivity R decreases with a rate of about 1.9 $\mu\Omega$ cm/hr (1 hour corresponds to a dose $\phi = 10^{14}$ fissions/cm^3). A saturation effect takes place at $\phi \geq 5 \times 10^{14}$ fissions/cm^3. After a dose of 5×10^{15} fissions/cm^3, the electrical resistivity decreases by ~10% (~17 $\mu\Omega$cm) but the saturation does not take place. The decrease in R is explained by a change in temperature dependence of α-plutonium's electrical resistivity due to a radiation defect buildup. (auth)

1301 ION IMPLANTATION. Wick, Gerald L. Science; 170: 425-7(23 Oct 1970).

A survey is presented of the ion implantation technique used in semiconductors and other solids. Conferences and groups interested in this technique are described. A brief account is given of the historical development and the discovery of ion channeling in crystals. The use of Rutherford backscattering of alpha particles to study impurity atom location and radiation damage in crystals is discussed. The manufacture of field-effect metal-oxide-semiconductor transistors (MOSFET) is considered in detail. Other possible applications of ion implantation are listed. (D.L.C.)

1302 CHANNELING EFFECTS IN LIGHT EMISSION FROM HELIUM ION BEAMS EXCITED BY A GOLD SINGLE CRYSTAL. Andersen, T.; Datz, S.; Hvelplund, P.; Soerensen, G. (Univ. of Aarhus, Denmark). Phys. Lett.; 33A: 121-2(5 Oct 1970).

The influence of channeling on foil-excited helium ion beams was investigated. The light emission showed a strong dependence on axial and planar directions in a thin gold crystal. (auth)

1303 DECHANNELING OF IONS. Kumakhov, M. A. (Moscow State Univ.). Phys. Lett.; 33A: 133-4(5 Oct 1970).

A statistical theory of ion dechanneling due to scattering by thermal vibrations of atoms is proposed. (auth)

1304 ROSETTE MOTION IN NEGATIVE-PARTICLE CHANNELING. Kreiner, H. J. (Univ., Munich); Bell, F.; Sizmann, R.; Harder, D.; Huettl, W. Phys. Lett.; 33A: 135-6(5 Oct 1970).

Bound negative particle motion along lattice rows provides high penetrability. Experimental transmission profiles for 5-, 10-, and 15-MeV electrons along ⟨100⟩ in 10 μm MgO exhibit a central penetration maximum of width (0.7 ± 0.1)°, (0.4 ± 0.1)°, and (0.3 ± 0.1)° respectively in agreement with the ψ_1 Lindhard angles for the bound motion. (auth)

1305 RADIATION DAMAGE IN TUNGSTEN CARBIDE. Hershkowitz, N.; Wender, S. A.; Oberley, L. W. (Univ. of Iowa, Iowa City). Phys. Lett.; 33A: 89-90(5 Oct 1970).

New evidence is found for radiation damage following Coulomb excitation in refractory compounds. Anomalous hyperfine interactions are simultaneously observed in γ-ray absorption spectra of ^{182}W, ^{184}W, and ^{186}W in tungsten carbide. (auth)

1306 FRACTIONATION EFFECT IN ANNEALING OF RADIATION-DAMAGED SILICON. Fang, P. H. (Electronics Research Center, Cambridge, Mass.); Ryan, J. L.; Tarko, H. B. Phys. Lett.; 33A: 75-6(5 Oct 1970).

By repeated irradiation and annealing, it was found that (1) the isochronal temperature increases as the instantaneous defect concentration is increased, (2) an unannealable defect occurs when the defect concentration is very high, and (3) both of these effects are dependent on the history of the irradiation and annealing. (auth)

Physical Properties

Refer also to abstracts 642, 643, 676, and 682.

1307 (CONF-700403-(Vol.1), pp 3-10) PERMANENT MAGNET PROPERTIES OF $PrCo_5$ ALLOY POWDERS. Strnat, Karl; Tsui, James (Dayton Univ., Ohio. Dept. of Electrical Engineering).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

The intermetallic compound $PrCo_5$ holds the promise of permanent magnets having energy products up to 36 MGOe, yet it has been neglected in favor of $SmCo_5$ in the recent efforts to develop rare earth-cobalt-based magnets. This paper reports the particle-size dependence of coercivity and hysteresis loop shape of mortar-ground powders, results of ballmilling experiments, and two ways to improve the properties by surface treatment of the particles. Intrinsic coercive forces up to $_MH_c$ = 5750 oersted were obtained by ballmilling. Mortar-ground powders of <10μm had $_MH_c$ = 3350 Oe. This could be improved to nearly 8000 Oe by metallizing the particles with zinc. Chemical surface polishing with 1% HNO_3 is another effective method to increase the coercivity. (auth)

1308 (CONF-700403-(Vol.1), pp 11-20) STRUCTURAL AND MAGNETIC PROPERTIES OF INTERMETALLIC COMPOUNDS IN THE TERNARY SYSTEM Y-Fe-Co. Kirchmayr, Hans R. (Ruhr Univ., Bochum (West Germany). Institut fuer Experimentalphysik).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

Samples with compositions of $Y(Fe_{1-v}Co_v)_2$, $Y_6(Fe_{1-x}Co_x)_{23}$, $Y(Fe_{1-\gamma}Co_\gamma)_5$, and $Y_2(Fe_{1-z}Co_z)_{17}$, were prepared by high-frequency melting and by arc melting. By x-ray diffraction and x-ray-fluorescence analysis the crystal structure, lattice spacings, and the actual compositions were determined. Solid solubility was observed for v = 0.0 to 0.4 and v = 0.7 to 1.0; for x = 0.0 to 0.2; for y = 0.7 to 1.0, and for z = 0.0 to 1.0. The magnetic measurements showed a marked dependence of the magnetization of YCo_2 on the mechanical treatment of the samples. The magnetization σ and the hyperfine field at the Fe nuclei reach a maximum for v = 0.3 to 0.4. In the $Y_6(Fe, Co)_{23}$ samples the Curie temperature T_c increased with x. With increasing y-values T_c and σ decreased. In Y_6Fe_{23} the crystallographic different lattice sites, occupied by Fe atoms, are also magnetically nonequivalent as is shown by Mössbauer measurements. (auth)

1309 (CONF-700403-(Vol.1), pp 21-33) MAGNETIC AFTEREFFECT AND AGING OF $Sm(Co,Cu,Fe)_5$ PERMANENT MAGNET ALLOYS. Mildrum, H.; Ray, A. E. (Dayton Univ., Ohio. Research Inst.); Strnat, K. (Dayton Univ., Ohio. Dept. of Electrical Engineering).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

Alloys of this type can be magnetically hardened by precipitation of a nonmagnetic phase. Magnets made from them show a very pronounced magnetic aftereffect. Once the magnetization reversal has started, the intrinsic induction continues to drop slowly, at constant field strength, for several minutes and in increments up to 50% of the saturation. This undesirable phenomenon was studied for $R(Co, Cu, Fe)_5$ alloys in different stages of heat treatment and for $SmCo_5$. R-Co alloy powders are subject to a degradation of their permanent magnet properties by aging. Air aging experiments were performed at room temperature and 125°C with powders of $SmCo_5$, $SmCo_{3.5}Cu_{1.5}$, and $SmCo_{3.5}Cu_{1.35}Fe_{0.4}$ subjected to various treatments. The degradation is very severe for $SmCo_5$ and for poorly heat-treated alloys with copper and iron substitution, while properly precipitation hardened samples of the latter type are rather stable. The results are discussed in terms of the metallurgical phase structure and models of the magnetization reversal mechanisms. (auth)

1310 (CONF-700403-(Vol.1), pp 34-40) MAGNETIC STRUCTURE OF $HoFe_2$. Moreau, J-M; Michel, C.; Simmons, M.; O'Keefe, T.; James, W. J. (Missouri Univ., Rolla).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

Neutron-diffraction and thermal magnetization analyses were made of $HoFe_2$. The magnetic structure is ferrimagnetic below the Curie temperature with the Ho moments coupled antiparallel to the Fe moments. The saturation moments at 4.2°K are 1.7 ± 0.2 and 9.5 ± 0.2 μ_B for Fe and Ho, respectively, corresponding to 6.1 μ_B per unit formula. It is concluded that the Ho-Ho inter-

actions decrease rapidly with increasing temperature and that the Ho–Fe interaction must be weak. (auth)

1311 (CONF-700403-(Vol.1), pp 41-52) MAGNETIC AND STRUCTURAL CHARACTERISTICS OF TERNARY INTERMETALLIC SYSTEMS CONTAINING LANTHANIDES. Leon, Burke; Wallace, W. E. (Pittsburgh Univ., Pa. Dept. of Chemistry).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Structural and magnetic characteristics of two sets of ternary systems were studied: $LnNi_{2-x}Al_x$ with Ln = Ce, Pr, Nd, Gd, Tb, Dy, Ho, and Er; and $Pr_{1-x}Ln_xCo_2$ where Ln = Dy and Ho. The temperature range covered was from 2 to 300°K. The latter ternaries exhibit the C15 structure for all values of x. In the $LnNi_{2-x}Al_x$ ternaries, there is an appreciable range of primary solubility for phases based on $LnAl_2$. The same is true for phases based on $LnNi_2$, except for $CeNi_2$; the solubility of $CeAl_2$ in $CeNi_2$ is below the level of detection. An intermediate phase (C22 structure) based on the composition LnNiAl was observed in all the Al-containing ternaries. All of the samples except CeNiAl exhibited Curie–Weiss behavior with paramagnetic moments in close agreement with that expected for free ions. CeNiAl has a very low susceptibility suggesting the effect of partial crystal field quenching and/or spin compensation (Kondo effect). Most of the $LnNi_{2-x}Al_x$ ternaries become ferromagnetic at low temperatures. The magnetic behavior of $PrNi_{2-x}Al_x$ with x = 1.85 to 1.95 is anomalous at low temperatures. The $Pr_{1-x}Ln_xNi_2$ ternaries exhibited normal paramagnetic behavior. They become ferrimagnetic at low temperatures. There is a threshold value of x (~0.2) below which Pr has no moment. The Co-containing systems do not exhibit Curie–Weiss behavior. They are ferrimagnetic at low temperatures with the Pr and Co moments aligned parallel and the Pr and Ln moments aligned antiparallel. (auth)

1312 (CONF-700403-(Vol.1), pp 53-62) MAGNETIC SUSCEPTIBILITY AND NUCLEAR MAGNETIC RESONANCE OF SOME RCu_5 COMPOUNDS. Buschow, K. H. J. (Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands). Forschungslaboratorium); van Diepen, A. M.; de Wijn, H. W. (Amsterdam Univ. (Netherlands). Natuurkundig Laboratorium).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Magnetic susceptibilities of the cubic RCu_5 compounds $TbCu_5$, $DyCu_5$, $HoCu_5$, $ErCu_5$, and $TmCu_5$ were measured between 2.1 and 300°K. At the higher temperatures, Curie laws are followed. The type of ordering changes with growing atomic number from antiferromagnetic to ferromagnetic, while $DyCu_5$ is metamagnetic at 2.1°K. The Knight shifts of the ^{63}Cu NMR in these compounds were measured between 100 and 300°K. The results are discussed in terms of the Ruderman–Kittel–Kasuya–Yosida theory. (auth)

1313 (CONF-700403-(Vol.1), pp 63-73) MAGNETIC PROPERTIES OF DYSPROSIUM THALLIUM THREE. Olsen, Clayton E.; Arnold, George P.; Nereson, Norris G. (Los Alamos Scientific Lab., N. Mex.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Neutron-diffraction and bulk susceptibility measurements were made on the intermetallic compound $DyTl_3$. The neutron-diffraction investigation confirmed the surmise of Baenziger and Moriarty that this compound had an ordered $AuCu_3$ structure. Below 11K, in addition to the nuclear reflections, a complex set of magnetic reflection appeared that could be indexed at 4.7K on a magnetic cell whose edges were four times the corresponding cube edges of the chemical cell. As yet, the magnetic structure has not been derived from the observed powder pattern. A solution of this magnetic structure requires the use of a single crystal. Bulk susceptibility measurements over the temperature interval 1.4K to 300K show the following: In the temperature interval 10 to 200K the Curie Weiss plot of 1/x vs T is linear with an intercept on the temperature axis of –20K confirming the antiferromagnetic nature of the ordered structure observed by neutron diffraction. The paramagnetic moment obtained from the slope of the Curie Weiss plot gave an indicated paramagnetic moment for the dysprosium of 11.3 Bohr magnetons which may indicate substantial crystal field effects and/or conduction electron polarization in this compound. At temperatures above 200K the observed reciprocal susceptibilities become smaller than Curie Weiss extrapolation. Below 11K the bulk susceptibility does not fall in the case of classical antiferromagnets but continues to rise although not as rapidly as would be expected if the compound were ferromagnetic with an inflection at 7.5°K. No remanance was observed in the compound. These results suggest that the antiferromagnetic structure is such that the aligned moments have a ferromagnetic component. The bulk susceptibility measurements below 3.5°K suggest the possibility of a second magnetic structure below 3.5°K. (auth)

1314 (CONF-700403-(Vol.1), pp 102-14) MAGNETIC INTERACTIONS AND CRYSTALLINE FIELD IN EQUIATOMIC RARE EARTH–NOBLE METALS COMPOUNDS. Pierre, Jacques (Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The RCu and RAg compounds with heavy rare earths are antiferromagnets with an ordered structure of (II II0) type. When a divalent metal is substituted for the noble one, the interactions become ferromagnetic. These variations are explained by means of indirect exchange theory. The crystalline field explains the variations of the susceptibilities in CeAg, PrAg, and NdAg at low temperatures and the directions of the rare earth moment in the order range. Directions parallel to ⟨001⟩ axis in TbCu and to ⟨111⟩ axis in HoCu were observed. (auth)

1315 (CONF-700403-(Vol.1), pp 310-21) ELECTRONIC TRANSITION IN CERIUM HYDRIDE. Libowitz, G. G.; Pack, J. G.; Howling, D. H.; Binnie, W. P. (Kennecott Copper Corp., Lexington, Mass. Ledgemont Lab.).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Resistivity measurements of cerium hydride single crystals as a function of hydrogen content in the range CeH_2 to CeH_3 have shown that there is a metal-to-semiconductor transition at a composition corresponding to approximately $CeH_{2.8}$. Measurements of resistivity as a function of temperature in metallic samples whose compositions ($CeH_{2.74}$ to $CeH_{2.77}$) are in proximity to that at the compositional transition revealed a sharp change in resistivity at about 245°K. In NMR studies of a polycrystalline sample of $CeH_{2.75}$ as a function of temperature, a sudden change in intensity of the proton resonance peak at approximately the same temperature was observed. A neutron-diffraction investigation of the corresponding deuteride, $CeD_{2.75}$, above and below the transition temperature, showed no change in structure. It is proposed that cerium hydride, of approximate composition $CeH_{2.75}$, transforms from the metallic state to a semiconducting state at about 250°K. (auth)

1316 (CONF-700403-(Vol.1), pp 322-32) ELECTRICAL RESISTIVITY AND MAGNETIC SUSCEPTIBILITY OF DEFINITE COMPOUNDS IN THE TIN–SAMARIUM SYSTEM. Percheron, Annick (Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Terres Rares); Lethuillier, P.; Feron, J. L. (Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire d'Electrostatique et Physique du Metal); Gorochov, O. (Paris Univ. (France). Laboratoire de Chimie Minerale).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

Electrical resistivities of the polycrystalline compounds $SmSn_3$, Sm_2Sn_3, and Sm_5Sn_3 were measured between 77°K and room temperature. These values were compared with samarium and tin resistivities. The temperature dependence of the electrical resistivities can be expressed by the following equations: $\rho_{SmSn_3} = (11.5 + 0.054\ T)\ 10^{-6}\ \Omega$ cm; $\rho_{Sm_2Sn_3} = (280 + 2.18\ T - 2.51 \cdot 10^{-3}\ T^2)\ 10^{-6}\ \Omega$ cm; and $\rho_{Sm_5Sn_3} = (210 + 0.234\ T)\ 10^{-6}\ \Omega$ cm. The magnetic behavior of these compounds was investigated over the temperature range 2 to 900°K. Curie–Weiss behavior was not observed. Neel points were observed for $SmSn_3$ and Sm_2Sn_3, respectively, at 9 and 11°K. Sm_5Sn_3 showed an anomaly of susceptibility between 120 and 160°K. Above 300°K, the susceptibility of the three compounds decreases with temperature with a minimum near 400°K. The temperature dependence of the electrical resistivity and the magnetic susceptibility of some compounds in the tin–samarium system were studied to define the nature of bonding in the compounds investigated. In fact, the exothermic enthalpy of formation of these compounds has indicated very strong interactions between tin and samarium atoms and a strong covalent or polar character of the bonding. The crystal structures and lattice parameters of these compounds are: $SmSn_3$, cubic $AuCu_3$ type, a = 4.677 Å; Sm_2Sn_3, tetragonal, a = 9.1 Å, c = 15.4 Å; and Sm_5Sn_3, hexagonal Mn_5Si_3 type, a = 9.089 Å, c = 6.610 Å. (auth)

1317 (CONF-700403-(Vol.1), pp 345-54) SEMICONDUCTION IN RARE EARTH OXIDES. Rao, C. N. R.; Rao, G. V. Subba (Indian Inst. of Tech., Kanpur. Dept. of Chemistry).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19–22, 1970. Volume I. Sessions A through H.

The defect structure and electrical transport properties of several rare earth sesquioxides and nonstoichiometric oxides were examined. These oxides have conductivities in the range 10^{-9} to 10^{-6} ohm^{-1} cm^{-1}. The nonstoichiometric oxides, LnO_x, with $1.50 \leq x < 1.75$ are p-type semiconductors, while the oxides with $1.75 < x \leq 2.00$ are n-type semiconductors. Fully or partly ionized cation vacancies seem to be predominant defects contributing to the defect structure in these oxides. On the basis of the conductivities and Seebeck coefficients, the mechanism of conduction in terms of the hopping model and the polaron theory are explained. The electrical conductivities (as a function of temperature and oxygen partial pressure) and Seebeck coefficients of several compositions of the solid solutions $CeO_2-Y_2O_3$ and $CeO_2-Nd_2O_3$ are examined. Considerable ionic contribution to the total conductivity was noticed at all compositions; the electronic conductivity was p- or n-type depending on the composition. Both the ionic and the electronic conductivity appear to go through a maximum around 30% $YO_{1.5}$ (or at 12.5% $NdO_{1.5}$). The results are interpreted in terms of ordered defect complexes. (auth)

1318 (CONF-700403-(Vol.1), pp 355-64) KONDO EFFECT AND THE INFLUENCE OF CRYSTALLINE ELECTRIC FIELD ON THE ELECTRICAL RESISTIVITIES OF THE INTERMETALLIC COMPOUNDS $CeAl_3$ AND $CeAl_2$. Rao, V. U. S.; Suski, W.; Craig, R. S.; Wallace, W. E. (Pittsburgh Univ., Pa. Dept. of Chemistry).

From Proceedings of the 8th rare earth research conference, Reno, Nevada, April 19-22, 1970. Volume I. Sessions A through H.

A method is proposed to evaluate the effect of the crystalline electric field on the spin-disorder resistivity of rare earth intermetallics and the procedure is used to interpret the resistivity vs temperature behavior of $CeAl_2$. Resistivity measurements performed on $CeAl_3$ in the temperature range 3 to 450°K indicate a peak at 33°K and a broad minimum at 310°K in the resistivity vs temperature curve. The results are explained as arising from the presence of the Kondo effect in addition to the influence of the crystalline electric field on the spin-disorder resistivity of $CeAl_3$. (auth)

1319 (CONF-700403-(Vol.1), pp 412-23) VACANCY AND CHARGE ORDERING IN THE Th_3P_4 STRUCTURE. Carter, Forrest L.; O'Hara, Margaret (Naval Research Lab., Washington, D. C.).

Vacancy ordering in the lanthanide sesquichalcogenides having the Th_3P_4 structure has been a long-standing problem. In such materials, with 1/9 of the metal sites unoccupied, vacancy pairing statistically has a high probability, but chemically such pairing appears unlikely. Models of the ordering of vacancies were sought that correspond to their maximum separation. Using a Wigner-Seitz cell approach, the all-space-filling dodecahedron associated with the metal sites in the Th_3P_4 structure was determined. The linking of these dodecahedron via their smaller triangular faces corresponds to a diamond-like structure of next-nearest metal neighbors and leads to two tetragonal space groups, $I4\bar{2}d-D_{2d}^{12}$ and $I\bar{4}-S_4^2$ as models for partial vacancy ordering. The first space group is suggested as corresponding to charge ordering in the Sm_3S_4 and Eu_3S_4 type semiconductors and the second suggests new classes of Th_3P_4 type compounds. While x-ray evidence for vacancy ordering in Ce_2S_3 is lacking, transport phenomena in Eu_3S_4 support a charge-ordered model. Madelung constant calculations for the various ordered structures are in progress. (auth)

1320 (IS-T-387) MAGNETIC FORM FACTOR OF THULIUM AND TERBIUM METALS. Brun, Torben Otto (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 95p. Dep. NTIS.

Thesis.

The magnetic form factors of thulium and terbium single crystals were measured with polarized neutrons. The form factor of thulium was measured at 4.2°K in a magnetic field of 10 kOe applied parallel to the c-axis. The magnetic structure of thulium at 4.2°K and in low fields (less than 28 kOe) applied parallel to the c-axis is an antiphase domain structure with a net ferromagnetic moment parallel to the c-axis. The magnitude of the moment is 1 μ_B per atom, and its magnetic form factor was determined. The form factor of terbium was measured at 298°k and in a magnetic field of 22 kOe applied parallel to both the a- and the b-axis. Terbium is paramagnetic at 298°K, and the magnitude of the induced moment in a field of 22 kOe is 0.8 μ_B per atom for the two directions of the field. Within the experimental uncertainty, the form factors for the directions of the magnetic field were identical. Theoretical form factors were calculated for both thulium and terbium, using the 4f wave functions of Freeman and Watson. A comparison between the theoretical and experimental form factors indicates that the free-ion wave functions of Freeman and Watson are too contracted for both metals. (auth)

1321 (IS-T-395) OPTICAL STUDIES OF CADMIUM. Bartlett, Roger James (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 105p. Dep. NTIS.

Thesis.

The reflectivity and/or absorptivity of cadmium was measured from 0.15 to 20 eV. Measurements were made using polarized light with the electric vector of the incident radiation both perpendicular and parallel to the c-axis of the crystal. In the visible and infrared spectra, both polarization cases had strong absorption peaks. In the perpendicular polarization case, the main peak was at 0.98 eV and was attributed mainly to transitions between bands two and three along the LH symmetry line. Also in this polarization, there was an absorption edge at 0.29 eV. This may be due to transitions near the point K in the Brillouin zone. For the parallel polarization case, the main absorption peak was at 1.10 eV. The absorption here was attributed to transitions between bands two and three along ΓK, ΓM and LH. No low-energy absorption edge was found for the parallel polarization case. Agreement between the experimental data and the theoretical calculations based on a nonlocal pseudopotential model was good. However, there was no agreement between the data and calculations based on a local pseudopotential model. At low temperatures, the long-wavelength absorptivities were approximately constant. This agrees with the theories of Kliewer and Fuchs and of Holstein for the anomalous skin-effect region. Using the theory of Kliewer and Fuchs and the experimental data, parallel and perpendicular effective masses were calculated. The values were 1.09 and 1.61 m, respectively. The weighted average of $m_\parallel^*$ and $m_\perp^*$ is in good agreement with the thermal effective mass for cadmium. The low-energy data support the theory of Kliewer and Fuchs and tend to confirm the volume absorption process suggested by Holstein. (auth)

1322 HYPERFINE FIELDS ON HAFNIUM NUCLEI IN IRON AND GADOLINIUM METAL. Murnick, D. E. (Bell Telephone Labs., Inc., Murray Hill, N. J.); Huefner, S.; Herskind, B. Z. Phys.; 226: 175-81(1969).

The recoil implantation perturbed angular correlation technique, IMPACT, was used to study the hyperfine interaction in ^{180}Hf in iron and gadolinium. The perturbed angular correlation through the Coulomb-excited 4^+ state was used, thus minimizing the effect of quadrupole interactions. The effective hyperfine fields on Hf in iron and gadolinium are determined to have the same sign, negative, and magnitudes of (507 ± 60) kOe and (304 ± 31) kOe, respectively. Results are compared with values reported from several other experiments ostensibly measuring the same quantity. Problems inherent in the various experimental techniques are considered. (auth)

1323 TEMPERATURE DEPENDENCE OF FLUORESCENCE DECAY OF URANYL SALTS. Pant, D. D.; Pant, H. C.; Pande, D. N. (DSB Government Coll., Naini Tal, India). Indian J. Pure Appl. Phys.; 6: 122-5(Mar 1968).

The lifetimes and relative quantum yields at various temperatures were measured for several uranyl salts. Using the simple Mott and Seitz approach for deactivation processes, the values of ΔE (activation energy) and A (pre-exponential factor) were calculated. A low frequency of nearly 90 cm^{-1} and another of nearly 2780 cm^{-1} are shown to take part in nonradiative dissipation. Individual peculiarities are pointed out. The sulfates have a distinctly higher value of ΔE. Discontinuities in the lifetimes with temperature are observed in uranyl nitrate frozen solution at about 220°K and uranyl potassium sulfate at about 380°K due to phase transformations. No changes on deuteration in the nonradiative temperature-dependent constant are observed. (auth)

1324 MAGNETIC SUSCEPTIBILITY OF MONOCLINIC Eu_2O_3. Kern, S.; Kostelecky, R.; O'Donnell, C. M. (Colorado State Univ., Fort Collins). Phys. Lett.; 33A: 27(21 Sep 1970).

The measured magnetic susceptibility of monoclinic Eu_2O_3 was found to be greater than that calculated from spectroscopic data, namely, 7.2×10^{-3} cgsu vs. 6.4×10^{-3} cgsu. Both values are lower than corresponding values for cubic Eu_2O_3. (D.L.C.)

1325 MECHANISMS FOR THE THERMAL CONDUCTIVITY OF ERBIUM. Nikol'skii, G. S.; Zvyagina, N. M.; Eremenko, V. V. (Physical-Technical Inst. of Low Temperature, Kharkov). Sov. Phys.-Solid State (Engl. Transl.); 12: 999-1000(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1275-7(Apr 1970).

A study was made of the possible causes of the anomalously large Lorenz number (9×10^{-8}) of Er. The effect of a magnetic field is shown to be primarily an effect on the magnon spectrum, and isotherms of the thermal resistance in a magnetic field were found to be very similar to magnetoresistance curves, implying a minor role for magnons in heat transfer. The large Lorenz number is attributed to the large effective masses of conduction

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electrons and to their scattering by oscillations in the magnetic moments. The electric and thermal resistivities of a series of Er–Y alloys were measured and found to confirm the hypothesis that the phonons are less sensitive than electrons to the magnetic oscillations. (D.L.C.)

1326 METALLIC ALLOYS AND EXCHANGE-ENHANCED PARAMAGNETISM: APPLICATION TO RARE-EARTH–COBALT ALLOYS. Bloch, D.; Lemaire, R. (CNRS, Grenoble, France). Phys. Rev., B; 2: 2648-50(1 Oct 1970).

A phenomenological theory is presented of the magnetic properties of two-component alloys, one of whose components has a permanent magnetic moment, and the other an exchange-enhanced paramagnetic susceptibility. The paramagnetic susceptibility, magnetic-ordering temperature, and magnetization at low temperature are discussed in terms of this theory, and the results obtained are applied to cubic alloys ACo_2 between rare earth (A) and cobalt. (auth)

1327 ELECTRICAL ANISOTROPIES OF PYROLYTIC GRAPHITE AND ITS COMPOUNDS. Yajima, Seishi; Hirai, Toshio; Aoki, Koichi (Tohoku Univ., Sendai). Radiat. Eff.; 4: 55-60(Jul 1970).

From International Conference on Nonmetallic Crystals, New Delhi, India. See CONF-690126.

The electrical resistivities and the electrical anisotropy of the pyrolytic graphite compounds containing silicon (0.02–4 wt% Si; PG(Si)) or bromine (0.1–12 wt% Br; PG(Br)) were examined at room temperature. The anisotropy of PG(Si) was closely related to its preferred orientation, which depends on the deposition temperature. The anisotropies of PG and PG(Si) are attributed to discontinuity in the stacking of the crystallites, as proposed by Guentert and Klein; the discontinuity increases with preferred orientation. Low values of the anisotropy for PG(Si), containing large amounts of silicon and having the considerably high preferred orientation, result from the disappearance in the discontinuity because of the presence of SiC between the crystallites. The anisotropy of PG(Br) increases with the amount of bromine. Almost all the bromine atoms may be ionized in PG(Br) according to Blackman et al. The effect of ionization on the anisotropy is not clear. (auth)

1328 INFLUENCE OF LATTICE DEFECTS ON γ–γ CORRELATIONS. Klyucharev, V. A.; Bozhko, V. P. (Kiev Inst. of Semiconductors). Ukr. Fiz. Zh.; 14: 1894-6(Nov 1969). (In Russian).

The influence of structural defects in metallic polycrystalline hafnium on the electric quadrupole bond was studied using a differential method which offered the necessary data on nuclear interactions with external electromagnetic field. The measurements were carried out with the 133- to 482-keV $\gamma\gamma$ cascade in ^{181}Ta and the fast-slow coincidence with time conversion into signal amplitude (time resolution $2\tau_0 = 3.2$ nsec). The theoretical curve obtained for the annealed specimen parameters: $2\tau_0 = 3.2$ nsec, $\omega_0 = 330$ Mhz, $\delta = 5\%$, and $\eta = 0$ or corresponded to the axial-symmetric electric quadrupole interactions with insignificantly diffused gradient from one nucleus to another. For specimens with structural defects, the parameters $2\tau_0 = 3.2$ nsec, $\omega = 330$ Mhz, $\delta = 15\%$, and $\eta = 0$. (R.V.J.)

1329 MAGNETIC PROPERTIES OF GADOLINIUM–COBALT COMPOUNDS. Strydom, O. A. W.; Alberts, L. (Rand Afrikaans Univ., Johannesburg). J. Less-Common Metals; 22: 503-9(Dec 1970).

A series of gadolinium–cobalt compounds are prepared and magnetization measurements performed providing new results in the gadolinium-rich end of the spectrum. The effect of conduction electron polarization is discussed. Magnetostriction measurements on the whole series are made and the unusual behavior of Gd_2Co in terms of forced magnetostriction is considered. (auth)

1330 SPACE-CHARGE-LIMITED CURRENTS IN β-RHOMBOHEDRAL BORON. Prudenziati, M. (Univ., Modena, Italy). Phys. Status Solidi (a); 3: K81-5(16 Sep 1970).

Space-charge-limited currents (SCLC) were measured in B single crystals in order to investigate trapping processes. A resistivity–temperature graph showed two slopes with activation energies of 0.44 eV at 300 to 180°K and 0.055 eV at 180 to 100°K. The current–voltage characteristics show an ohmic region at very low voltages followed by an intermediate region where I increases as U^n ($n > 2$), and a high-voltage region where I increases as U^2. An interpretation of the results in terms of SCLC theory is given, and a total concentration of traps of the order of 10^{11} cm^{-3} and $T_c = 220$°K are obtained. The mobility of the injected carriers is found to increase exponentially with temperature with an activation energy of 0.046 eV. (D.L.C.)

1331 MAGNETISM OF RARE EARTH ALLOYS. Lemaire, R.; Pauthenet, Rene; Schweizer, J. (CNRS, Grenoble, France). IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 153-7(Jun 1970).

From 2nd European Conference on Hard Magnetic Materials, Milan, Italy. See CONF-690964.

The main properties of the rare earth elements are discussed, emphasizing their magnetic properties. However, it is difficult to use these elements in practice, because their Curie points are located below room temperature. In order to take advantage of the properties of these substances, they can be alloyed with iron, cobalt, or nickel. The properties of the rare earth–cobalt alloys are discussed, the phase diagram and the crystal structures are described, and the ferrimagnetic behavior is explained. Alloys of interest for magnet applications are selected. (auth)

1332 PHYSICAL METALLURGY AND MAGNETIC MEASUREMENTS OF $SmCo_5$–$SmCu_5$ ALLOYS. Hofer, Franz (Brown Boveri Research Center, Baden, Switzerland). IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; MAG-6: 221-4 (Jun 1970).

From 2nd European Conference on Hard Magnetic Materials, Milan, Italy. See CONF-690964.

The magnetic properties of the hexagonal intermetallic compounds involving the rare-earth and 3d transition metals have been reported in the literature. These alloys look promising as fine-particle permanent magnets. A large number of samples in the system $SmCo_{5-x}Cu_x$ were prepared by induction melting under a protective atmosphere, and annealed at various temperatures. An outstanding feature of these alloys is their high intrinsic coercive force. After annealing at low temperatures, they show coercive forces above 20 kOe and an energy product of about 8×10^6 G · Oe. The most important factors determining the coercive force appear to be the chemical composition, the cooling rate, the alignment of the $SmCo_5$-rich phase, and the annealing treatment. Examination by electron microscopy and electron probe techniques suggests a spinodal decomposition of a supersaturated solid solution into two phases, one rich in $SmCo_5$ and the other rich in $SmCu_5$. (auth)

1333 ORBITAL MAGNETIC SUSCEPTIBILITY OF BERYLLIUM. Chhotray, K.; Misra, P. K. (Utkal Univ., Orissa, India). Phys. Lett.; 33A: 69-70(5 Oct 1970).

The orbital magnetic susceptibility of beryllium was calculated by the pseudopotential method of Misra and Roth, which was recently extended to complicated metal structures by Misra et al. (auth)

Moessbauer Effects and NMR

Refer also to abstracts 194, 688, 1710, 1716, and 1739.

1334 EIGENVALUES, EIGENFUNCTIONS, AND TRANSITION PROBABILITIES FOR AN ELECTRON–NUCLEAR COUPLED SYSTEM WITH DIPOLAR INTERACTION. Gupta, S. K.; Narchal, N. L. (Panjabi Univ., Patiala, India). Progr. Theor. Phys. (Kyoto); 44: 1-12(Jul 1970).

The eigenvalues, eigenfunctions, and radiative induced transition probabilities are calculated perturbatively for an electron–nuclear coupled spin system with dipolar interaction for arbitrary relative orientations of the crystal symmetry axis, the external static magnetic field, and the time-varying field. Exact calculations are also given for an $S = \frac{1}{2}$, $I = \frac{1}{2}$ system. The importance of these results in dynamic nuclear orientation experiments is also discussed. (auth)

1335 ISOMER SHIFTS OF THE 90 keV γ RAYS OF ^{99}Ru IN RUTHENIUM COMPOUNDS. Kaindl, G.; Potzel, W.; Wagner, F.; Zahn, Ursel; Moessbauer, R. L. (Technische Hochschule, Munich). Z. Phys.; 226: 103-15(1969).

The recoilless nuclear resonance absorption of the 90-keV γ-rays of ^{99}Ru was observed in a variety of chemical compounds of ruthenium in the oxidation states +2 through +8 at 4.2°K. For most of the compounds, isomer shifts increasing monotonically with the oxidation state of ruthenium were found. This behavior, which may essentially be attributed to the decreasing number of 4d electrons, and the few exceptions from it are discussed qualitatively on the basis of the molecular orbital theory. (auth)

1336 ROLE OF VARIOUS SPIN–LATTICE RELAXATION PROCESSES IN THE FORMATION OF THE HYPERFINE STRUCTURE OF A MOESSBAUER LINE. Svetozarov, V. V. (Engineering Physics Inst., Moscow). Sov. Phys.-Solid State (Engl. Transl.); 12: 826-32(Oct 1970).

Translated from Fiz. Tverd. Tela; 12: 1054-63(Apr 1970).

Single-phonon and two-phonon relaxation processes are considered by means of the diagram method developed by Kagan and

Afanas'ev. After the diagrams which make the main contribution to the correlation function (determining the form of the spectrum) have been separated, it is possible to sum the perturbation series. It is shown that two-phonon relaxation processes described by second-order perturbation theory are important only in substances with a large splitting of the levels in the crystal field and at very low temperatures (up to a few degrees K). In the remaining cases, single- and two-phonon processes described by first-order perturbation theory are dominant. This circumstance enables one to obtain simple relationships between the broadenings of the various lines of the hyperfine structure and to simplify the method of obtaining information on spin–lattice relaxation from Moessbauer spectra. The broadening of the lines of the hyperfine structure of a paramagnetic iron ion with spin $S = 5/2$ in a crystal field of arbitrary symmetry is considered as a specific example. (auth)

1337 NUCLEAR-MAGNETIC-RESONANCE STUDIES OF DILUTE MOLYBDENUM–COBALT AND TUNGSTEN–COBALT ALLOYS. Narath, Albert (Sandia Labs., Albuquerque, N. Mex.); Brog, K. C.; Jones, W. H. Jr. Phys. Rev., B; 2: 2618-29(1 Oct 1970).

A detailed NMR study of the dilute magnetic alloys MoCo ($T_K \approx 24°K$) and WCo ($T_K \approx 11°K$) was carried out in the temperature range 0.5 to 300°K and for cobalt impurity concentrations of 0.1 to 1.0 at. %. Two distinct types of ^{59}Co impurity resonances were observed in every sample. The dominant resonance is characterized by a large temperature-dependent negative frequency shift and is associated with the magnetic impurity sites. Severe inhomogeneous broadening of the magnetic-site resonances indicates an inhomogeneous impurity polarization resulting from long-range oscillatory spin polarizations of the conduction electrons. A weaker, essentially unshifted resonance whose intensity increases with increasing impurity concentration is associated with relatively nonmagnetic impurity sites in regions of high local impurity concentration. At temperatures well above T_K, the magnetic-site resonance shifts exhibit the same Curie-Weiss temperature dependences (with $\theta = -T_K$) as do the respective bulk susceptibilities. The slope $dK/d\chi$ yields cobalt hyperfine fields of −23 and −3 kOe/μ_B in MoCo and WCo, respectively. In the temperature range 0.5 to 4°K, the ^{59}Co resonance shifts in MoCo, and to a much lesser extent in WCo, become composition-dependent unlike the bulk susceptibility. The low-temperature (1 to 4°K) ^{59}Co spin–lattice relaxation rates in MoCo are directly proportional to T and have magnitudes that correlate well with the observed resonance shifts using a Korringa-like relationship. From an analysis of the experimental Korringa products, a positive 1 to 2% orbital contribution to the measured resonance shifts is inferred. The molybdenum and tungsten nuclear resonances exhibit inhomogeneous broadening and enhanced spin–lattice relaxation rates. Within the experimental uncertainties, the widths and enhancement factors scale linearly with the impurity susceptibility. The results provide no evidence for the existence below T_K of significant nonperturbative long-range sp.n-correlation contributions to the field-induced magnetization of isolated cobalt impurities in either MoCo or WCo. In this regard MoCo and WCo, despite their lower Kondo temperatures, resemble AuV ($T_K \approx 300°K$). (auth)

1338 SPIN-DIFFUSION LIMITATIONS FOR HIGH-SENSITIVITY NMR TECHNIQUES. Moran, P. R.; Lang, D. V. (Univ. of Wisconsin, Madison). Phys. Rev., B; 2: 2360-8(1 Oct 1970).

The experimental sensitivity attainable in employing such high-sensitivity NMR techniques as double nuclear resonance and rotating-frame relaxation can be limited by spin-diffusion rates within the bulk detected spin system. A diffusion kernel solution to the driven spin-diffusion equation is developed and the detected-system magnetization decay rate induced by a dilute concentration of pumping centers calculated. The results show that spin-diffusion suppression of the induced decay rate depends only upon local parameters, is independent of concentration of pumping centers, and, in all systems whose experimental study has thus far been reported, would produce at most a 10% effect. These particular conclusions apply only to the case of completely dispersed pumping centers, but the general approach can be extended to treat aggregated systems. The description of the spin-diffusion behavior yields results in agreement with existing experimental data, but in disagreement with previous theoretical treatments. (auth)

1339 PROPOSED ISOMER SHIFT STANDARDS FOR MOESSBAUER SPECTROSCOPY. Cohen, R. L. (Bell Telephone Labs., Inc., Murray Hill, N. J.); Kalvius, G. M. Nucl. Instrum. Methods; 86: 209-12(1970).

The need for isomer shift reference standards for Moessbauer spectroscopy and appropriate criteria for choosing such standards are discussed. Using these considerations, an extensive table of proposed reference materials is given. (auth)

Theory

Refer also to abstract 980.

Theoretical Physics

1340 QUANTUM-MECHANICAL HARMONIC OSCILLATOR UNDER A RANDOM QUADRATIC PERTURBATION. Mollow, B. R. (Univ. of Massachusetts, Boston). Phys. Rev., A; 2: 1477-80(1 Oct 1970).

The behavior of a quantum-mechanical harmonic oscillator under a random perturbation of the form $f(t)q^2$ is discussed. Equations are obtained governing the time evolution of the Wigner function and the weight function for the P representation. The latter function satisfies a fourth-order differential equation in contrast to the simpler second-order equation obeyed by the Wigner function. (auth)

1341 GENERALIZED KRAMERS–FOKKER–PLANCK EQUATION. Bashkirov, A. G. (Karpov Physico-Chemical Inst., Moscow); Zubarev, D. N. Physica; 48: 137-45(31 Jul 1970).

The generalized Kramers–Fokker–Planck equation for a rather general quantum system described by a set of gross variables is derived by the method of the nonequilibrium statistical operator developed by one of authors. (auth)

1342 ACTION-ANGLE VARIABLES IN QUANTUM MECHANICS AND THEIR RELATION WITH SECOND QUANTIZATION. Biswas, A. C. (Univ. Libre, Brussels). Physics; 48: 123-5 (31 Jul 1970).

The ν–N formalism of second quantization introduced by Prigogine et al. is nothing but a contracted form of action-angle variables in quantum statistics introduced through Glauber relations. (auth)

1343 POINTWISE ESTIMATES OF EIGENFUNCTIONS FOR SCHROEDINGER OPERATORS. Bazley, N. W.; Fankhauser, H. R. (Battelle Inst., Geneva). Chem. Phys. Lett.; 7: 121-2(1 Oct 1970).

A new method is derived for the pointwise estimation of wave functions of a class of Schroedinger operators. It is based upon the use of an arbitrary trial function in a Sobolev inequality and permits the rigorous evaluation of many physical quantities for the first time. (auth)

1344 QUANTUM-MECHANICAL CURVATURE THEOREM. Silverman, J. N.; Van Leuven, J. C. (Battelle Inst., Geneva). Chem. Phys. Lett.; 7: 37-42(1 Oct 1970).

A general quantum-mechanical curvature theorem of the form $d^2\epsilon/d\lambda^2 \leq \langle\psi|d^2H/d\lambda^2|\psi\rangle$ is established by means of perturbational–variational theory; here, ψ and ϵ are the exact eigenfunctions and eigenvalues of the Schrödinger time-independent equation, H is the Hamilton operator, and λ is any real parameter occurring in H. The theorem is also established for arbitrary optimum variational solutions to the Schrödinger equation. Several applications of the curvature theorem are discussed in conjunction with perturbation theory and the stability of approximate wave functions. (auth)

1345 NEW FORMULATION OF STOCHASTIC THEORY AND QUANTUM MECHANICS. V. THE RELATIVISTIC SPINLESS PARTICLES. de la Pena-Auerbach, Luis (Univ. Nacional de Mexico, Mexico City). Rev. Mex. Fis.; 19: 133-45 (1970).

An approximate relativistic formulation of the stochastic theory of quantum mechanics is developed for spinless particles. The method used parallels as much as possible the nonrelativistic derivation, which assumes local equilibrium. This last condition reflects itself in that the theory developed is valid only for times greater than $\hbar/mc^2$. (auth)

1346 SOME COMMENTS ON STOCHASTIC QUANTUM MECHANICS. de la Pena-Auerbach, L.; Velasco, R. M.; Cetto, A. M. (Univ. Nacional de Mexico, Mexico City). Rev. Mex. Fis.; 19: 193-205(1970).

Some aspects of stochastic quantum mechanics are considered. First, a formal but elementary derivation, based on classical principles, of Schroedinger's equation is presented; this suggests the stochastic (Markovian) origin of quantum phenomena. It is shown that for stationary states without a net flux of matter, the particles belonging to the quantum ensemble distribute themselves in such a way as to guarantee a (relative) minimum value for the total energy of the ensemble. Finally, it is shown explicitly that the analogy between quantum mechanics and a clas-

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sical fluid described by the Navier–Stokes equations lacks any profound physical content. (auth)

1347 CHARGE MOTION IN SUPERIMPOSED COULOMB AND MAGNETIC FIELDS. Gajewski, R. (FOM-Instituut voor Plasma-Fysica, Jutphaas, Netherlands). Physica; 47: 575-95 (30 Jun 1970).

Equations of motion for a charge moving in a Coulomb field and a superimposed constant magnetic field become dimensionless when distances are measured in units of an introduced characteristic length l. For the problem of scattering, allowed regions are determined where a scattered particle can be found. For the problem of bound states, resonance is predicted, classically, between radial and longitudinal oscillations. Quantum-mechanical interpretation of that resonance is provided. The magnetic field required for resonance is enormous in the case of an electron moving in vacuum in the field of a proton, but reasonable for an electron belonging to an exciton in InSb. (auth)

1348 GREEN'S FUNCTIONS AND THEIR PHYSICAL SIGNIFICANCE. Stedman, G. E. (Queen Mary Coll., London). Cesk. Cas. Fys.; 20: 252-73(1970). (In Czech).

The motivation for the use of the Green's function (GF) concept in mathematical physics and the diversity of its applications are discussed, with reference to both classical and quantum-mechanical problems. First, the impulse response GF is defined and its use is demonstrated in a problem in electrostatics. The connection with the wave response GF is explained and illustrated in an electronics problem. After a review of the use of these concepts in classical problems, their unification in quantum mechanics is discussed. An outline of the ideas of quantum field theory prefaces the discussion of the application of GFs to quantum mechanical problems, especially in many-body theory. The two most important mathematical techniques used in the evaluation of GFs are compared. (auth)

1349 ANALYSIS OF NONLINEAR INITIAL-BOUNDARY-VALUE PROBLEMS IN RECOMBINATION AND DIFFUSION KINETICS. Wilhelm, H. E. (Colorado State Univ., Fort Collins). J. Chem. Phys.; 53: 1677-82(1 Sep 1970).

The time-dependent diffusion and convection equation with a recombination reaction is reduced by means of a transformation to a differential equation, in which the nonlinear term represents a small perturbation. The general procedure of solution for the nonlinear differential equation is then established by means of the method of successive approximations. As concrete illustrations, some typical initial-boundary-value problems which are of interest in radiation chemistry (recombination in clusters) and plasma chemistry (plasma decay experiments) are treated analytically. (auth)

1350 QUANTUM MECHANICAL RIGID ROTATOR WITH AN ARBITRARY DEFORMATION. I. DYNAMICAL GROUP APPROACH TO QUADRATICALLY DEFORMED BODY. Ui, Haruo (Tohoku Univ., Sendai). Progr. Theor. Phys. (Kyoto); 44: 153-71(Jul 1970).

A rigorous definition is given of "rigidity" in the framework of quantum mechanics. It is argued that, corresponding to the measurement of the shape of the body—at least within Gedanken experiments—there must exist a set of operators associated with this shape. The "rigidity" of the body is defined such that the shape is in principle measurable without any quantum mechanical uncertainties. For a quadratically deformed rigid body, the commutation relations among the shape operators and angular momentum form a Lie algebra, which is shown to be the semi-direct product of the O(3) to a five-dimensional Abelian group, $O(3) \times T_5$. The irreducible representations of this dynamical group are explicitly constructed by employing an elementary algebraic method. It is found that the representation can be specified naturally in terms of Bohr and Mottelson's deformation parameters β and γ as (β^2, $\beta^3 \cos 3\gamma$) and that every member of all the possible rotation bands of the rigid rotator is contained in the single irreducible representation once and only once. Several remarks are added concerning the relation of the dynamical group to the more general rotation–vibration group SL(3R). (auth)

1351 COHERENT STATES AND TRANSITION PROBABILITIES IN A TIME-DEPENDENT ELECTROMAGNETIC FIELD. Malkin, A. A.; Man'ko, V. I.; Trifonov, D. A. (Lebedev Inst. of Physics, Moscow). Phys. Rev., D; 2: 1371-85(15 Oct 1970).

New time-dependent invariants for the N-dimensional nonstationary harmonic oscillator and for a charged particle in a varying axially symmetric classical electromagnetic field are found. For these quantum systems, coherent states are introduced, and the Green's functions are obtained in closed form. For a special type of electromagnetic field which is constant in the remote past and future, the transition amplitudes between both arbitrary coherent states and energy eigenstates are calculated and expressed in terms of classical polynomials. The adiabatic approximation and adiabatic invariants are discussed. In the special case of a particle with time-dependent mass, the solution of the Schrödinger equation is found. The symmetry of nonstationary Hamiltonians is discussed, and the noncompact group U(N,1) is shown to be the group of dynamical symmetry for the time-dependent N-dimensional oscillator. (auth)

1352 LINEAR POLARIZATION OF RADIATION OF CHARGE IN MOTION IN ARBITRARY FIELD. Bagrov, V. G.; Klimenko, Yu. I. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; No. 3, 104-7 (May-Jun 1969). (In Russian).

Linear polarization of radiation produced by a charged particle in motion along an arbitrary trajectory was studied within the aspects of classical theory. Various cases of polarization were analyzed. It is shown that, in the event of prompt radiation at any arbitrary particle velocity, only a very small portion of the radiation is found in the component in which the electrical vector of the radiation field is orthogonal to the acceleration. The mean polarization time of radiation charge in motion in a weak electromagnetic field is investigated. (tr-auth)

1353 PERTURBATION THEORY AND THE SPIN PROBLEM. Balasubramanian, S. (Madurai Univ., India). Indian J. Pure Appl. Phys.; 7: 313-16(May 1969).

The transition amplitudes for a spin-one particle in crossed, time-dependent magnetic fields are calculated by a slight variant of the usual perturbation method, the variation being necessitated by the fact that the conventional method yields results contrary to expectations. The cases of both rotating and oscillating fields are considered. (auth)

1354 ENERGY LEVELS AND LORENTZ INVARIANCE. Synge, J. L. (Dublin Inst. for Advanced Studies). Nature (London); 228: 271-2(17 Oct 1970).

For an atom in an excited state S′ and with energy E′ falling to a state S with lower energy E, with emission of a photon with frequency ν, according to a basic postulate of quantum mechanics this frequency is related to the energies by $h\nu = E' - E$. The theoretical calculation of E and E′ is carried out in the rest-frame of the atom and it would appear that ν is the frequency observed in that frame. Conservation of momentum, however, demands that the atom recoils on emission of the photon and hence there are two rest-frames—the rest-frame of S′ and that of S. The recoil is small and hence the two rest-frames are nearly the same, but in spectroscopy, wavelengths are sometimes given with 8-figure accuracy. The question discussed is whether such accuracy is consistent with neglect of the small difference between two rest-frames. The hydrogen spectrum is, in particular, considered. It is concluded that, in general terms, the error is not manifest for 8-figure accuracy in spectroscopy, but does appear in the ninth figure. The author was led to consider these matters in an attempt to review arguments by which an upper bound is set to the proper mass of a photon, but followed the usual hypothesis that the proper mass of a photon is zero, in order to point out the relativistic inadequacy of the above formula. It is emphasized that proper mass is the most important Lorentz invariant scalar associated with any system. (UK)

PHYSICS (HIGH ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstract 428.

1355 (TID–25571) RESEARCH IN ELEMENTARY PARTICLE PHYSICS. Technical Progress Report, May 31, 1970. Kirsch, Lawrence; Schnitzer, Howard J. (Brandeis Univ., Waltham, Mass. Dept. of Physics). Contract AT(30-1)-3178. 10p. Dep. NTIS.

Research on theoretical and experimental properties of elementary particles at Brandeis University from September 1, 1969 to April 30, 1970 is reported briefly. A list of publications is included. (J.F.P.)

1356 (UH–511-87-70) HIGH ENERGY PHYSICS GROUP ANNUAL PROGRESS REPORT. (Hawaii Univ., Honolulu. Dept. of Physics and Astronomy). 15 Oct 1970. Contract AT(04-3)-511. 92p. Dep. NTIS.

Research on high-energy physics during 1970 at the University of Hawaii is reported. Both experimental and theoretical research are discussed. The discussion includes spark chamber and bubble chamber experiments and the instrumentation. A list of publications is given. (J.F.P.)

1357 ACHIEVEMENTS IN NUCLEAR PHYSICS DURING THE TWENTY-FIVE YEARS OF POLISH PEOPLE'S REPUBLIC (1945–1970). Miesowicz, Marian (Inst. of Nuclear Physics, Krakow). Nukleonika; 14: 1185-91(1969).

A review is given of Polish nuclear studies with reference to the short history of this science in Poland. Basic studies in low- and high-energy nuclear physics as well as the investigations of the condensed phase by nuclear methods are discussed. (auth)

1358 APPARATUS AND METHODS OF STUDYING PROCESSES OF MULTIPLE PRODUCTION AT HUNDREDS OF GeV. Guseva, V. V.; Dobrotin, N. A.; Denisov, E. V.; (and others). Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 3-28(1970). (In Russian).

Descriptions are given of the installation of the Pamir high-elevation station of USSR Academy of Sciences and of the improved installations of the Tyan–Shan station (at the 3200 m over the sea level). The installations were used for studying a series of inelastic interactions of cosmic ray particles with target nuclei at several hundreds of GeV. The main device of the installations was the Wilson chamber placed in a magnetic field and an ionization colorimeter placed directly under the chamber. Such an arrangement facilitated measurements of primary particle energies momenta, and the angle of emission of secondary particles. Ionization produced by secondary particles in the Wilson chamber was evaluated, the energy transferred to neutral pions was determined, and interactions were determined by analyzing electron–nuclear showers in the colorimeter. (tr-auth)

1359 METHODS FOR TREATING EXPERIMENTAL DATA OBTAINED BY MEANS OF WILSON CHAMBER. Guseva, V. V.; Zelevinskaya, N. G.; Kotel'nikov, K. A.; (and others). Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 29-39(1970). (In Russian).

Methods for treating data obtained by Tyan–Shan high-elevation station with the Wilson chamber and ionizing radiation are described. A semi-automatic device was used for measuring coordinate images of particle track drops on the stereophotography of the Wilson chamber in the event of nuclear interactions of particles with cosmic rays at hundreds of GeV energies. The spatial position of separate drops was measured by using coordinate of corresponding points. Particle momenta were determined by curvatures of the tracks in magnetic field. Maximum momenta for the momenta of nearly 50 cm and field of H = 500 Gs equal to 25 GeV/s. Descriptions are also given of the method for finding the shower generation point, the direction of shower axis, and separation of electron–positron pairs from a number of charged secondary particles and other types of experimental data. (tr-auth)

Electromagnetic

Refer also to abstracts 429, 1022, and 1439.

1360 (AD–708409) ASYMMETRIC ELECTRON PAIR PRODUCTION ON CARBON. Simonds, R. M.; Richter, B. (Stanford Univ., Calif. High-Energy Physics Lab.). Nov 1968. Contract Nonr-225(67). 51p. (HEPL–586; SLAC-PUB–522). NTIS.

The cross section for the reaction gamma + C yields e (+) + e (–) + C was measured for a series of kinematic points giving nuclear momentum transfers in the region 0.2 – 0.7 F (–2), with incident photon energies in the region for photoproduction of the first two pi-nucleon resonances. Measurements were made, using asymmetric detection geometry, of electron and positron cross sections for each point. (auth)

1361 (DESY–70/31) VECTOR MESON DOMINANCE IN PHOTO- AND ELECTROPRODUCTION. Schildknecht, D. (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Jul 1970. 37p. Dep. NTIS (U. S. Sales Only).

In this version of the talk given at the "Rencontre de Moriond" the more recent developments are stressed, referring to last years review talks on the VDM in photoproduction for additional material. (auth)

1362 (DESY–70/33) PHOTOPRODUCTION OF ω MESONS FROM NUCLEI. Braccini, P. L.; Bradaschia, C.; Castaldi, R.; Foa, L.; Luebelsmeyer, K.; Schmitz, D. (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Jul 1970. 19p. Dep. NTIS (U. S. Sales Only).

We report on an experiment of ω photoproduction from nuclei (C, Al, Zn, Ag, Ta, Pb; 5.7 GeV mean photon energy) performed at DESY. The experimental apparatus detects the $\pi^0\gamma$ decay of the produced ω mesons. Results concerning the ω-photon coupling $\gamma_\omega^2/4\pi$ and concerning the ω-nucleon total cross section σ_ω are derived. The dependence of these results on the different possible models of analysis is discussed. (auth)

1363 (DESY–70/36) π^0-ELECTROPRODUCTION AT Δ (1236) AND AT FOUR MOMENTUM TRANSFER OF 15 f^{-2}. Albrecht, W.; Brasse, F. W.; Dorner, H. (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Aug 1970. 13p. Dep. NTIS (U. S. Sales Only).

The electroproduction of the $\Delta(1236)$ was investigated through the π^0 channel at a four momentum transfer of 15 f^{-2}. Angles and momenta of the secondary electron and of the proton were measured in coincidence to obtain the differential cross section for the reaction $e + p \rightarrow e + p + \pi^0$. The angular distribution for s and p waves of the outgoing pion and nucleon in their center-of-mass system was fitted to the cross sections. The resultant coefficients of the angular distributions are given as functions of the mass W of the pion nucleon system for 15 f^{-2}. In a small range of W around the resonance the contributions of the resonant multipoles M_{1+}, E_{1+} and S_{1+} to the cross section are also given. (auth)

1364 (DESY–70/39) DETERMINATION OF THE PHOTOPRODUCTION PHASE OF ρ^0 MESONS. Alvensleben, H.; Becker, U.; Chen, M.; (and others) Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Aug 1970. 11p. Dep. NTIS (U. S. Sales Only).

Large-angle electron–positron pairs from the reaction $\gamma + Be \rightarrow Be + e^+ + e^-$ were measured in the e^+e^- invariant mass region of $610 < m < 850$ MeV/c^2. The phase of the photoproduction amplitude of the ρ meson at 4.1 to 6.1 GeV was found to deviate from pure imaginary by $11.8 \pm 4.4°$ which corresponds to a ratio of the real to imaginary ρ-nucleon amplitude of $B = 0.2 \pm 0.1$. (auth)

1365 (DESY–70/40) OBSERVATION OF COHERENT INTERFERENCE PATTERN BETWEEN ρ, ω DECAYS. Alvensleben, H.; Becker, U.; Bertram, William K.; (and others) (Deutsches Elektronen-Synchrotron, Hamburg(West Germany)). Aug 1970. 10p. Dep. NTIS (U. S. Sales Only).

A high statistics experiment measuring the structure of e^+e^- mass spectrum from photo-production of ρ and ω mesons is reported. At 5.1 GeV, based on 4000 events, analysis of the spectra yields a ratio of vector meson photon coupling constants $\gamma_\omega^2/\gamma_\rho^2 = 9.4\ ^{+2.2}_{-1.6}$ and a ρ,ω phase difference $\varphi_{\omega\rho} = 41 \pm 20°$. (auth)

1366 (DESY–70/42) ELECTROMAGNETIC PROTON FORM FACTORS AT SQUARED FOUR-MOMENTUM TRANSFERS BETWEEN 1 AND 3 $(GeV/c)^2$. Bartel, W.; Buesser, F.-W.; Dix, W.-R.; Felst, R.; Harms, D.; Krehbiel, H.; Kuhlmann, P. E.; McElroy, J.; Weber, G. (Deutsches Elektronen-Synchrtron, Hamburg (West Germany)). Aug 1970. 13p. Dep. NTIS (U. S. Sales Only).

Electron–proton elastic scattering cross sections were measured at four-momentum transfers between 1.0 and 3.0 $(GeV/c)^2$ and at electron scattering angles between 10 and 20° and at about 86° in the laboratory. The proton electromagnetic form factors G_E and G_M were determined. The results indicate that $G_E(q^2)$ decreases faster with increasing q^2 than $G_M(q^2)$. (auth)

1367 (PURC-4159-6) MEASUREMENT OF THE NEUTRAL BRANCHING RATIOS OF THE ETA MESON. Technical Report No. 2. Buttram, Malcolm T. (Princeton Univ., N. J. Elementary Particles Lab.). 17 Aug 1970. Contract AT(30-1)-4159. 91p. Dep. NTIS.

The eta neutral branching ratios were measured from the energy spectrum of single gamma rays in the eta rest frame. From a sample of 7200 eta decay gamma rays momentum analyzed in an optical spark chamber pair spectrometer, the branching ratios $(\eta \to \gamma\gamma/\eta \to \text{neutrals}) = (53.5 \pm 1.8)$ %, $(\eta \to \pi^0\pi^0\pi^0/\eta \to \text{neutrals}) = (43.9 \pm 1.9)$ %, $(\eta \to \pi^0\gamma\gamma/\eta \to \text{neutrals}) = (2.6 \pm 2.4)$ % were determined under the assumption that no other neutral modes were significant. An estimate of possible systematic effects is included in the errors. (auth)

1368 (UCRL-19753) THE ρ^0-ω INTERFERENCE PARAMETERS IN DIFFRACTIVE PHOTOPRODUCTION OF VECTOR MESONS ON HYDROGEN. Moffeit, K. C.; Bingham, H. H.; Fretter, W. B.; (and others) (California Univ., Berkeley. Lawrence Radiation Lab.). Aug. 1970. Contract W-7405-eng-46. 6p. Dep. NTIS.

The reaction $\gamma p \to \pi^+\pi^- p$ was examined for evidence of ρ^0-ω interference. Assuming the ratio of the ρ^0 and ω photoproduction amplitudes $|A_\rho/A_\omega|^2 = 7.1 \pm 0.7$, it is found that $\mathrm{Re}(\delta e^{i\beta}) = 2.3 \pm 0.9$ MeV and $\mathrm{Im}(\delta e^{i\beta}) = -0.4 \pm 0.9$ MeV, where $\delta(\approx 2.3$ MeV) is the mass mixing parameter and $\beta(\approx -9°)$ is the relative phase of the ρ^0-ω amplitudes. The result, obtained using a hydrogen bubble chamber, agrees with the high-statistics Daresbury result using photoproduction on carbon. (auth)

1369 (UH-511-81-70) MULTIBODY PHOTOPRODUCTION AT NAL. Yount, D. (Hawaii Univ., Honolulu). [1970]. 6p. Dep. NTIS.

The possibility of performing multibody photoproduction experiments at NAL is reviewed. (auth)

1370 MEASUREMENTS OF THE LONGITUDINAL AND LATERAL DEVELOPMENT OF ELECTROMAGNETIC CASCADES IN LEAD, COPPER, AND ALUMINUM AT 6 GeV. Bathow, G. (Deutsches Elektronen-Synchrotron, Hamburg); Freytag, E.; Koebberling, M.; Tesch, K.; Kajikawa, R. Nucl. Phys.; B20: 592-602(1970).

The longitudinal and radial development of electromagnetic cascades, initiated by 6 GeV electrons, was measured in lead, copper and aluminum by means of silver-phosphate dosimeter glasses. The measured energy deposition was compared with Monte-Carlo calculations by Völkel, especially at large depths and radii. Excellent agreement was found for the transition curves up to 40 radiation lengths and for the lateral distributions up to 4 Molière units. Between 4 and 12 Molière units the calculations tend to underestimate the energy deposition. (auth)

1371 MEASUREMENT OF PROTON COMPTON SCATTERING AT 6 GeV AND SMALL MOMENTUM TRANSFERS. Buschhorn, G.; Griegee, L.; Dubal, L.; (and others) (DESY, Hamburg. Univ., Hamburg). Phys. Lett.; 33B: 241-4(12 Oct 1970).

Compton scattering on protons was measured at a mean photon energy of 6 GeV and four-momentum transfers $-t$ between 0.06 and 0.60 $(\mathrm{GeV/c})^2$. The differential cross section shows a diffraction-like behavior. The cross section extrapolated to $t = 0$ is in fair agreement with the optical point. Discrepancies with the vector meson dominance model are pointed out. (auth)

1372 SINGLE PHOTOPRODUCTION OF η-MESONS ON HYDROGEN IN FORWARD DIRECTION AT 4 AND 6 GeV. Braunschweig, W.; Erlewein, W.; Frese, H.; (and others) (Univ., Bonn. Deutsches Elektronen Synchrotron, Hamburg). Phys. Lett.; 33B: 236-40(12 Oct 1970).

The differential cross section of the reaction $\gamma p \to \eta p$ was measured at the Deutsches Elektronen Synchrotron (DESY) at mean photon energies of 4 and 6 GeV in the momentum transfer range between zero and 1.4 GeV^2. The data show a slight maximum around $t = -0.15$ GeV^2 and fall off smoothly till $t = -1.4$ GeV^2. There is no indication of a dip around $t = -0.5$ GeV^2. (auth)

1373 ELECTROMAGNETIC PROTON FORM FACTORS AT SQUARED FOUR-MOMENTUM TRANSFERS BETWEEN 1 AND 3 $(\mathrm{GeV/c})^2$. Bartel, W.; Bueszer, F.-W.; Dix, W.-R.; (and others) (DESY, Hamburg. Univ., Hamburg). Phys. Lett.; 33B: 245-8(12 Oct 1970).

Electron-proton elastic scattering cross sections were measured at four-momentum transfers between 1.0 and 3.0 $(\mathrm{GeV/c})^2$ and at electron scattering angles between 10 and 20° and at about 86° in the laboratory. The proton electromagnetic form factors G_E and G_M were determined. The results indicate that $G_E(q^2)$ decreases faster with increasing q^2 than $G_M(q^2)$. (auth)

1374 PHOTOPRODUCTION OF π^0 MESONS FROM NEUTRONS AROUND THE N(1518) RESONANCE. Yoshimura, Yoshio (Kyoto Univ.). Mem. Fac. Sci., Kyoto Univ., Ser. Phys., Astrophys., Geophys., Chem.; 33: 143-59(Mar 1970).

The experiment on the photoproduction of π^0 mesons from neutrons was carried out, by using a liquid deuterium target, at the pion angle of 90° in the center of mass system and in the energy region around the N(1518) resonance. The reaction $\gamma + n \to \pi^0 + n$ was identified by detecting the neutron and two γ-rays decaying from the π^0 meson, with a scintillation counter and a pair of lead glass Čerenkov counters, respectively. The result seems to be consistent with the previous results that the isovector part is dominant in the D13- amplitude of the π meson photoproduction on the free nucleon around the N(1518) resonance, from the measurement of the reaction $\gamma + d \to \pi^0 + d$. (auth) (Japan)

1375 PHOTOPRODUCTION OF MUON PAIRS WITH INVARIANT MASSES BETWEEN 930 AND 1770 MeV. Earles, D. R.; Faissler, W. L.; Gettner, M.; (and others) (Northeastern Univ., Boston). Phys. Rev. Lett.; 25: 1312-16(2 Nov 1970).

An experiment on photoproduction of muon pairs with invariant masses between 930 and 1770 MeV is reported. The measured invariant-mass spectrum is in good agreement with theoretical quantum electrodynamics predictions plus a contribution from $\varphi \to \mu^+ + \mu^-$ at invariant masses near 1020 MeV. A quantum electrodynamics cutoff $\Lambda \geq 1.9$ BeV (2 standard deviations) and a $\varphi \to \mu^+ + \mu^-$ branching ratio equal to $(2.17 \pm 0.06) \times 10^{-4}$ are obtained. For masses above the φ, limits which are approximately 100 times smaller than the rho are placed on resonance production. (auth)

1376 RHO PRODUCTION WITH LINEARLY POLARIZED PHOTONS. Criegee, L. (Deutches Elektronen-Synchrotron, Hamburg); Franke, G.; Loeffler, G.; (and others). Phys. Rev. Lett.; 25: 1306-8(2 Nov 1970).

The process $\gamma p \to \rho^0 p \to \pi^+\pi^- p$ was studied with linearly polarized photons between 1.4 and 3.3 GeV. Almost pure diffractionlike behavior in the whole energy region was observed. (auth)

1377 WIDE ATMOSPHERIC SHOWERS AND PARTICLE INTERACTIONS AT ENERGIES EXCEEDING 10^{13} eV. Nikol'skii, S. I. Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 100-56(1970). (In Russian).

Experimental data are presented on the wide showers and other phenomena induced by cosmic radiation exceeding 10^{13} eV. It was found at energies exceeding 10^{13} eV in addition to the well known processes of pionization and isobar mechanism of pion formation it is necessary to add the data on additional energy transmission by interacting nucleons into electron-photon cascades. The probability of transmission of over 70% of the nucleon energy into the electron-photon shower comprised $\frac{1}{3}$ of the probability of inelastic collisions of the nucleon with the atmospheric atomic nuclei considerations of additional process clarified many obscure additional assumptions. Data obtained on wide atmospheric showers at mountain level were used for determining a series of experimental data without any additional assumptions. (R.V.J.)

1378 TRANSITION EFFECTS IN IONIZATION CALORIMETER. Fetisov, I. N. Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 212-25(1970). (In Russian).

Transitional effects of electromagnetic cascades developing in lead and passing through the copper walls of ionization chambers were measured using an electron beam in an accelerator at 100 to 550 MeV energies. The magnitude of the transition coefficient normalized for all the cascade was equal to: $\bar{K}(Z) = (1.9 \pm 0.1)/(1.075$ to $0.03\ Z)$ where Z is 2.5 to 6.5 mm, Z is the thickness of the copper wall. The transition factor for Z = 2.5 mm during the maximum of cascade development was 1.6 ± 0.16 and increased with the increase of the cascade age s, reaching the magnitude of 2.7 ± 0.3 at $s = 1.2$ parameter. (R.V.J.)

1379 Δ PRODUCTION VIA $\gamma p \to \Delta\pi$ BY LINEARLY POLARIZED PHOTONS AT 2.8 AND 4.7 GeV. Bingham, H. H. (Univ. of California, Berkeley); Fretter, W. B.; Moffeit, K. C.; (and others). Phys. Rev. Lett.; 25: 1223-6(26 Oct 1970).

The production of $\Delta(1236)$ by linearly polarized photons at 2.8 and 4.7 GeV was studied using a hydrogen bubble chamber. At 2.8 GeV the cross sections for $\gamma p \to \Delta^{++}\pi^-$ $(\gamma p \to \Delta^0\pi^+, \Delta^0 \to p\pi^-)$ were found to be 3.7 ± 0.4 μb $(0.5 \pm 0.2\mu\mathrm{b})$; at 4.7 GeV, $1.0 \pm 0.1\mu$b $(0.16 \pm 0.09\ \mu\mathrm{b})$. Measurement of the parity asymmetry, P_σ, for Δ^{++} production with $|t| < 0.5$ GeV^2 yielded the values -0.27 ± 0.12 and -0.53 ± 0.15 at 2.8 and 4.7 GeV, respectively, whereas pure one-pion exchange would lead to $P_\sigma = -1$. (auth)

1380 COMPTON SCATTERING FROM HYDROGEN BETWEEN 5 AND 17 GeV. Anderson, R. L. (Stanford Univ., Calif.); Gustavson, D.; Johnson, J.; (and others). Phys. Rev. Lett.; 25: 1218-23(26 Oct 1970).

Measurements were made on Compton scattering for photon energies between 5 and 17 GeV and t values −0.06 to −1.1 $(GeV/c)^2$. The data were obtained by performing a coincidence between the Stanford Linear Accelerator Center 1.6-GeV/c spectrometer and a Lucite shower counter. The scattering appears diffractive out to high t values, but the cross sections seem not to be in good agreement with the prediction of a strict vector-meson-dominance model. (auth)

1381 PHOTOPRODUCTION OF ρ^- MESONS ON DEUTERONS BETWEEN 1 AND 5 GeV. Hilpert, H. G. (Technische Hochschule, Aachen); Lauscher, P.; Idschok, U.; (and others). Nucl. Phys.; B21: 93-107(1970).

From a measurement of the reaction $\gamma d \rightarrow p_s p \pi^- \pi^0$ (p_s means spectator proton) in a deuterium bubble chamber exposed to a bremsstrahlung beam, the cross section for the reaction $\gamma d \rightarrow p_s p \rho^-$ was determined for $|t| = -(q_\gamma - q_{\rho^0})^2 < 1.1$ GeV^2. It has a maximum of 8 ± 2 μb for photon energies between 1.4 and 1.8 GeV and is of the order of 1 μb for photon energies above 3.5 GeV. For the cross section without restriction in the square of the four-momentum transfer, upper limits are given. (auth)

1382 LONGITUDINAL DISTRIBUTION OF CHERENKOV LIGHT FROM EXTENSIVE AIR SHOWERS. Charman, W. N. (Atomic Energy Research Establishment, Harwell, Eng.); Mongain, E. O. Lett. Nuovo Cim.; 4: 724-6(17 Oct 1970).

It is found that any UV-sensitive light receiver is biassed heavily towards detecting those Cherenkov photons which originate close to the receiver. It is observed that this may have a considerable effect on the observed duration of the Cherenkov light pulse. It is suggested that even if there are no detectable abnormalities in the early development of showers, since the UV receiver is very sensitive to the persistence of a strong shower core, a combination of light receivers sensitive to the visible and to the ultraviolet region might give information on the nature of the primary particle. (J.F.P.)

Weak

1383 (COO-1195-195) A TEST OF THE $\Delta S = \Delta Q$ SELECTION RULE IN K^0_{e3} DECAY. Mantsch, Paul Matthew (Illinois Univ., Urbana). Oct 1970. Contract AT(11-1)-1195. 69p. Dep. NTIS.

Thesis.

An experiment was performed at the Argonne AGS to test the validity of the $\Delta S = \Delta Q$ weak interaction selection rule for the decay $K^0(\bar{K}^0) \rightarrow \pi^\pm e \nu$. K^0 mesons were produced by a 3-GeV π^- beam on a carbon target in the reaction $\pi^- + p \rightarrow \Lambda^0 + K^0$. Events were reconstructed on the basis of the trajectories of the kaon decay products in optical spark chambers located in a magnetic field. The electron from the decay was identified by its shower in heavy-plate spark chambers. The presence of the associated Λ^0 was deduced from its decay $\Lambda^0 \rightarrow \pi^- + p$ in spark chambers near the target. Decay times for the K^0's were measured over a proper time interval of 0.5 to 6.5 K^0_S lifetimes from production. Decay time distributions for both signs of the decay lepton were corrected for geometrical efficiency and fit to theoretical distributions. The complex quantity x, determined from the fit, measured the magnitude and phase of the ratio of $\Delta S = -\Delta Q$ to $\Delta S = \Delta Q$ decay amplitudes. A nonzero magnitude for x would imply a violation of the $\Delta S = \Delta Q$ rule, whereas an imaginary part for x would reveal a violation of T and hence CP invariance. The results of the experiment based on 342 events are: Re $x = -0.05 \pm 0.12$ and Im $x = -0.13 \pm 0.11$. These results are completely consistent with no violation of the $\Delta S = \Delta Q$ rule or of T invariance. (auth)

1384 (PURC-4159-9) PRECISE MEASUREMENT OF THE K_1^0-K_2^0 MASS DIFFERENCE. Technical Report No. 3. Sulak, Lawrence R. (Princeton Univ., N. J. Elementary Particles Lab.). 28 Sep 1970. Contract AT(30-1)-2137. 115p. Dep. NTIS.

Thesis.

The $K_1 - K_2$ mass difference was measured by the "gap method" to high precision. This method is particularly insensitive to knowledge of the detection efficiency of the apparatus, the nuclear regeneration parameters, and the argument of η_+. The K_2 beam flux is monitored by the K_{e3} decay rate. The measurement yields $|\Delta m| = (0.534 \pm 0.006)\ 10^{10}\ sec^{-1}$. Expressed in units of the inverse K_1 lifetime, $\tau_1 = 0.862 \times 10^{-10}$ sec, $|\delta| = 0.460 \pm 0.005$. This result, combined with other recent measurements[15,16] for the argument of η_+, yields arg $\eta_+ = 39^0 \pm 5^0$. (auth)

1385 (SLAC-125) MEASUREMENT OF THE TWO PHOTON DECAY OF THE K_1^0 MESON. Enstrom, James E. (Stanford Linear Accelerator Center, Calif.). Sep 1970. Contract AT(04-3)-515. 108p. Dep. NTIS.

A measurement of the rate $\Gamma(K_L^0 \rightarrow 2\gamma)$ was made relative to the rates $\Gamma(K_L^0 \rightarrow 3\pi^0)$, $\Gamma(K_L^0 \rightarrow \pi^\pm \mu\ \nu_\mu)$, and $\Gamma(K_L^0 \rightarrow \pi^\pm e^\mp \nu_e)$ using a spark chamber scintillation counter experiment. Using published branching ratios of the three body decays relative to the rate $\Gamma(K_L^0 \rightarrow$ all), the branching ratio $\Gamma(K_L^0 \rightarrow 2\gamma)/\Gamma(K_L^0 \rightarrow$ all) has been found to be $(4.5 \pm 1.0) \times 10^{-4}$, based on 23 valid decays, which were separated from a small background. The result is compared with theoretical predictions and other experimental measurements. (auth)

1386 (UCRL-20078) EXPERIMENTAL LIMIT ON THE BRANCHING RATIO FOR $K_2^0 \rightarrow l\bar{l}$. Clark, A. R.; Elioff, T.; Field, R. C.; Frisch, H. J.; Johnson, R. P.; Kerth, L. T.; Wenzel, W. A. (California Univ., Berkeley. Lawrence Radiation Lab.). 17 Aug 1970. Contract W-7405-eng-48. 13p. (CONF-700806-44). Dep. NTIS.

From 15th International Conference on High Energy Physics, Kiev, USSR.

The experimental limit on the $K_2^0 \rightarrow l + \bar{l}$ branching ratio was found to be 2.3. The instrumentation and data analysis for this experiment are described. (J.F.P.)

1387 (UCRL-20079) MEASUREMENT OF THE BRANCHING RATIO $K^+ \rightarrow e^+\nu/K^+ \rightarrow \mu^+\nu$. Clark, A. R.; Cork, B.; Elioff, T.; Kerth, L. T.; McReynolds, J. F.; Newton, D.; Wenzel, W. A. (California Univ., Berkeley. Lawrence Radiation Lab.). 20 Aug 1970. Contract W-7405-eng-48. 14p. (CONF-700806-45). Dep. NTIS.

From 15th International Conference on High Energy Physics, Kiev, USSR.

The measured branching ratio $K^+ \rightarrow e^+ + \nu/K^+ \rightarrow \mu^+ + \nu$ was found to be $2.15 \pm 0.35\ (10)^{-5}$. The instrumentation and data analysis for these decays are described. (J.F.P.)

1388 (UH-511-80-70) INELASTIC INTERACTIONS OF NEUTRINOS IN THE NAL HYDROGEN BUBBLE CHAMBER: SOME IDEAS ABOUT ASSOCIATED MUON, PHOTON, AND HADRON DETECTORS. Cence, Robert J.; Peters, Michael W.; Peterson, Vincent Z.; Yount, David E. (Hawaii Univ., Honolulu). 4 May 1970. 11p. Dep. NTIS.

In the discussion of the proposed experiment on inelastic interactions of neutrinos in the hydrogen bubble chamber, consideration is given to accurate determination of the incident neutrino energy, resolution of muonic electromagnetic and hadronic components of final-state energy and particle flux, maximum detail in event reconstruction, and simplicity and flexibility of apparatus needed in addition to the bubble chamber. Details of the design are given. (J.F.P.)

1389 (UH-511-84-70) EXTERNAL VERSUS INTERNAL MUON IDENTIFICATION IN THE 15-FOOT BUBBLE CHAMBER. Mukhin, A.; Yount, D. (Hawaii Univ., Honolulu). 22 Jul 1970. Contract AT(04-3)-511. 13p. Dep. NTIS.

Two methods for identifying muons from neutrino interactions in the 15-foot bubble chamber are compared: the first uses a 1-m-thick lead plate inside a neon filling; the second uses optical spark chambers interspersed with walls of concrete external to the bubble chamber. (auth)

1390 POSSIBLE EXISTENCE OF HEAVY LEPTONS. Ramm, C. A. (CERN, Geneva). Nature (London); 227: 1323-9(26 Sep 1970).

Muon–pion invariant mass distribution ($M_{\mu\pi}$) observed in neutrino interaction and in the decays of the K_L^0 are compatible with the possible existence of a neutral lepton with a mass in the range $0.42 < M_{\mu\pi} < 0.437$ GeV. (auth) (UK)

1391 SEARCH FOR $K_L \rightarrow \mu^+\mu^-$ DECAY. Darriulat, P.; Ferrero, M. I.; Grosso, C.; (and others). Phys. Lett.; 33B: 249-52(12 Oct 1970).

A new upper limit to the branching ratio for $K_L \rightarrow \mu^+\mu^-$ decay was set. No event was observed. The result is $\Gamma(K_L \rightarrow \mu^+\mu^-)/\Gamma(K_L \rightarrow$ all) $\leq 2.6 \times 10^{-8}$ with 90% confidence level. (auth)

1392 DETECTION OF THE WEAK INTERMEDIATE BOSON THROUGH ITS HADRONIC DECAY MODES. Cline, D. (Univ. of Wisconsin, Madison); Mann, A. K.; Rubbia, C. Phys. Rev. Lett.; 25: 1309-12(2 Nov 1970).

It is shown that the hadronic decay modes of the weak intermediate boson W produced by high-energy neutrinos provide a unique and unambiguous experimental signal of the production and decay of the W, even in the absence of any information about the number, the configuration, or the momenta of the decay products. This method of detecting the hadronic decay modes of the W, in conjunction with previously utilized methods for detecting the leptonic decay modes, should allow a search for the W to be made which is independent of any assumptions about the hadronic-to-leptonic branching ratio of the W. (auth)

1393 MEASUREMENT OF THE $\Delta S = -\Delta Q$ AMPLITUDE FROM K_{e3}^0 DECAY. Sciulli, F. J.; Gallivan, J. D.; Binnie, D. M.;

XUM

(and others) (California Inst. of Tech., Pasadena). Phys. Rev. Lett.; 25: 1214-18(26 Oct 1970).

The time distribution of the $\pi^+e^-\bar{\nu}$ and $\pi^-e^+\nu$ modes was measured from initial K^0's in a spark-chamber experiment performed at the Bevatron. From 1079 events between 0.2 and 7 K_S^0 lifetime, it is found that $ReX = -0.069 \pm 0.036$, $ImX = +0.108^{+0.088}_{-0.078}$. This result is consistent with X = 0 (relative probability = 0.25), but more than 4 standard deviations from the existing world average, +0.14 − 0.13i. (auth)

Strong (Baryon-Induced)

Refer also to abstract 1713.

1394 (CONF-700806-49) MULTIPION FINAL STATES IN $\bar{p}p$ ANNIHILATIONS AT 940 MeV/c. Burns, R. R.; Condon, P. E.; Donahue, J.; Mandelkern, M. A.; Schultz, J. (California Univ., Irvine. Dept. of Physics). [1970]. 20p. Dep. NTIS.

From 15th International Conference on High Energy Physics, Kiev, USSR.

Results are reported on four pion and five pion final states from antiproton annihilations in hydrogen in the vicinity of 940 MeV/c. Cross sections for 4π and 5π are found to be 3.6 and 14.6 mb, respectively. Abundant resonance production is observed, with fits indicating that quasi-two-body production constitutes approximately half the four pion events. Evidence of ρ-ω interference in these events is also presented. (auth)

1395 (KFK-1216) INVESTIGATION OF THE ANGULAR CORRELATION IN THE THREE-NUCLEON REACTION d + p → p + p + n. Brueckmann, H.; Kluge, W.; Matthaey, H.; Schaenzler, L.; Wick, K. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik). Jun 1970. 13p. (CONF-700419-3). Dep. NTIS (U. S. Sales Only).

From Meeting of the American Physical Society, Washington, D. C.

The reaction d + p → p + p + n was investigated by kinematically complete experiments at a deuteron bombarding energy of 52.3 MeV. The aim of a systematic study was to explore the contribution of n-p and p-p FSI at many pairs of angles. The data were analyzed using the Watson-Migdal theory. The n-p and p-p scattering lengths and the cross sections for the production of the FSI-pairs in singlet and triplet states were extracted. The scattering lengths obtained were found to be in good agreement with the values known from free nucleon-nucleon scattering. The resulting angular distributions of the singlet and triplet cross sections turn out to be quite different. The close relation between the angular distribution for the triplet cross section and the angular distribution of d-p elastic scattering is discussed. In separate runs kinematics were changed in order to obtain the angular distribution of the FSI-pairs in their cm-system. (auth)

1396 (UCRL-20077) STUDY OF Λ-NUCLEON INTERACTIONS IN DEUTERIUM. Kadyk, J. A.; Chan, J. H.; Gaposchkin, P.; Trilling, G. H. (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 10p. (CONF-700806-48). Dep. NTIS.

From 15th International Conference on High Energy Physics, Kiev, USSR.

Inelastic Λ + N interactions below 1.500 GeV/c in a deuterium bubble chamber were observed. Momentum and angular distributions and cross sections for the interactions $\Lambda + d \rightarrow \Sigma^- + 2p$ and $\Lambda + d \rightarrow \Lambda + 2p + \pi^-$ and the Λ pathlength distribution were found. (J.F.P.)

1397 OBSERVATION OF ANTIPROTONIC ATOMS. Bamberger, A. (Max-Planck-Institut fuer Kernphysik, Heidelberg); Lynen, U.; Piekarz, H.; (and others). Phys. Lett.; 33B: 233-5(12 Oct 1970).

X-rays originating from the antiprotonic cascade were observed for several elements. From the energies of the measured antiprotonic transitions of $_{81}Tl$, the mass of the antiproton could be determined to be 938.3 ± 0.5 MeV. With this result the masses of the antiproton and the proton are equal within 0.5 MeV with a confidence of 68%. The magnetic moment of the antiproton shows up in a broadening of the n = 10 → n = 9 transition. (auth)

1398 FIZIKA ELEMENTARNYKH CHASTITS I KOSMICHESKIKH LUCHEI. SBORNIK STATEI. (Elementary Particle and Cosmic Ray Physics. Collection of Articles). Azimov, S. A. (ed.). Tashkent; Izdatel'stvo Fan Uzbekskoi SSR (1969). 118p.

Nine articles are included on experimental and theoretical studies of inelastic and elastic collisions of strongly interacting elementary particles (hadrons) at very high (up to tens of GeV) and superhigh cosmic rays (of 10^2 to 10^4 GeV) energies. Descriptions are given of operations using spark chambers with large effective area for cosmic rays and large effective Cherenkov detectors. (R.V.J.)

1399 DOUBLE EMISSION OF HEAVY FRAGMENTS (Z ≥ 4) AT HIGH-ENERGY INTERACTIONS. Deka, G. C. (Cotton Coll., Gauhati, India); Bhuyan, H. R. Indian J. Pure Appl. Phys.; 6: 251-2(1968).

Emission of heavy fragments (Z ≥ 4) was studied in interactions initiated by 24- and 20-GeV/c. protons separately in two nuclear emission stacks. In a large sample of stars, 315 heavy fragments were observed and analyzed. Their angular distribution was found to be nearly isotropic which is in agreement with the "evaporation" theory; 62 double emissions were analyzed and a strong angular correlation between the pairs was noticed. Higher excitation of the disintegration seems to facilitate the emission of these fragments. (auth)

1400 EMISSION OF HAMMER TRACKS IN 20-GeV/c PROTON AND 3.5-GeV/c π^--MESON INTERACTIONS WITH HEAVY NUCLEI OF EMULSIONS. Deka, G. C. (Cotton Coll., Gauhati, India); Deka, K. C.; Talukdar, G. N.; Bhuyan, H. R. Indian J. Pure Appl. Phys.; 6: 479-81(1968).

Six hundred and eighty-one "hammer" tracks were observed in interactions of 20-GeV/c protons and 3.5 GeV/c π^--mesons in two nuclear emulsion stacks. The energy spectra and the angular distributions of the fragments are studied, and the results compared with the predictions of the "evaporation" theory. The values of the parameters found suitable for interpreting the experimental observations are: T = 11 MeV, V = 3 MeV, and $\beta = 0.015$ for the proton interactions; and T = 10 MeV, V = 5 MeV, and $\beta = 0.010$ for the pion interactions. (auth)

1401 PRELIMINARY ANALYSIS OF 5-GeV/c ANTIPROTON-NUCLEON INTERACTIONS IN PHOTOGRAPHIC EMULSIONS. Padmavathi, S. V.; Rao, Rukmini; Kamal, A. A. (Osmania Univ., Hyderabad, India). Indian J. Pure Appl. Phys.; 6: 154(Mar 1968).

Preliminary results from an analysis of 204 stars, selected from an unbiased sample and presumed to represent antiproton-nucleon interactions, are presented. Two events are consistent with elastic scattering with free protons and six correspond to charge exchange reactions. The cross section for inelastic interactions is determined. It is inferred that $\sigma_{in} \approx \sigma_{pp}$ at this energy characteristics of nonannihilation events are compared with those of proton interactions at similar energy. (auth)

1402 EXPERIMENTAL DATA ON INELASTIC PROCESS OF STRONG INTERACTIONS AT 100 TO 3000 GeV AND THEIR INTERPRETATION. Slavatinskii, S. A. Tr. Fiz. Inst., Akad. Nauk SSSR; 46: 40-99(1970). (In Russian).

The basic experimental data concerning multiple production of mesons during nucleon-nucleon interactions at .250 GeV are discussed. It is shown that nucleons as an average spend 40% of their energy on the production of pions (with the kaons forming 5%). The most probable magnitude of nucleon energy losses is about 20%. In ⅓ of this number for all interactions the loss of energy by colliding nucleons differs by a factor of about 2. In such interactions asymmetric in the center-of-mass system, there were observed dispersions of charged mesons into the frontal and trailing hemisphere forming asymmetric showers. In the coordinate system in which the symmetric dispersion of mesons, angular distribution close to isotropic, and momentum distribution for 90% pions are described by Planks function at temperature of T = (0.8 ± 0.2) $\mu\pi$, where $\mu\pi$ are the pion mass. For the energy range from 100 to 3000 GeV data were obtained on the multiplicity as a function of the energy $n_s = 4.2 \lg (E_0 - 0.3)$ where E_0 is the primary energy in nucleon mass units. The interpretation of experimental data is based on the phenomenological models and the theory of peripheral interactions. A model of formation of one and two heavy meson clusters of a fireball was analyzed. (R.V.J.)

1403 QUASI-NUCLEON NUCLEAR INTERACTIONS OF 23-GeV PROTONS IN PHOTO EMULSION IRRADIATED IN PULSED MAGNETIC FIELD AT 180 kOe. Zhdanov, G. B.; Tret'yakova, M. I.; Chernyavskii, M. M. Tr. Fiz. Inst., Akad. Nauk SSSR: 46: 177-99(1970). (In Russian).

Characteristics of quasi-nucleon interactions of 23-GeV protons in photoemulsions were investigated. The presence of strong magnetic fields (180 keV) enabled one to determine the charge symbols and to measure the particle momenta with greater accuracy than in ordinary photoemulsion. It was found that the angular distribution of π mesons and protons in the pn-interactions was progressively asymmetric ($\alpha_\pi = 0.25 \pm 0.08$, $\alpha_p = 0.2 \pm 0.12$); with the multiplicity increase the character of meson and nucleon energy distributions changed significantly; the distribution across particle momenta differed sharply in the case in which the particles were selected according to the minimum angle to the primary or energy-separate particle. The mean factor of inelasticity in

EMI was 0.52 ± 0.04; moreover, the ratio of energies transmitted to the charged and neutral mesons was 1.5 : 1. The analysis of angular, momentum distributions and also transverse momenta indicated a higher participation of asymmetric nucleon excitations in peripheral processes. (tr-auth)

1404 INELASTIC PN INTERACTIONS AT 3.7 GeV/c. Cohn, H. O. (Oak Ridge National Lab., Tenn.); McCulloch, R. D.; Bugg, W. M.; Condo, G. T. Contract AT(40-1)-3956. Nucl. Phys.; B21: 505-14(1970).

Cross sections for N^*(1238) production arising from various inelastic reactions of 3.7 GeV/c protons with deuterons are presented. It is found that N^* production in the reaction $pn \rightarrow pn\pi^+\pi^-$ is considerably smaller than in the pp and $\bar{p}p$ analogue reactions. An upper limit of 350 μb is found for the N^*(1400) production cross section. (auth)

1405 ENERGY TRANSFER TO NEUTRAL PIONS IN HIGH ENERGY NUCLEAR INTERACTIONS. Gopalakrishnan, N. V. (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci., Sect. A; 71: 242-56(May 1970).

The fraction of energy transferred to the neutral pions (K_{π^0}), in an interaction of high energy (> 20 GeV) N-particles (nucleons and pions) with atomic nuclei, is estimated from the data collected, using a total absorption spectrometer (TAS) and a multiplate cloud chamber. The average value of K_{π^0} ($\bar{K}_{\pi^0}$) is found to be 0.12 ± 0.01 in the energy range 20–100 GeV ($\bar{E}_0$ = 35 GeV) and 0.19 ± 0.02 in the region of > 100 GeV ($\bar{E}_0$ = 206 GeV). The value of $\bar{K}_{\pi^0}$ obtained in different experiments and its dependence on the primary energy are discussed. An increase in $\bar{K}_{\pi^0}$ in pion-nucleus collisions with the energy of the pion or an increase in the ratio of pions to protons, at 800 gm/cm^2, in the energy range of a few tens of GeV to a few hundred GeV or both is to be invoked to explain the energy dependence of $\bar{K}_{\pi^0}$ observed in this investigation. (auth)

1406 REACTION MECHANISM OF THE DIFFRACTIVE GENERATION OF PIONS BY 20-GeV PROTONS. Azimov, S. A.; Gulyamov, U. G.; Chernova, L. P.; Chernov, G. M. (Inst. of Nuclear Physics, Tashkent). Dokl. Akad. Nauk SSSR; 192: 1241-3(21 Jun 1970). (In Russian).

The diffraction dissociation reaction p + nucleus → p + π^+ + π^- + nucleus of protons with a 20.8 GeV/momentum on the nuclei of the photoemulsion exposed to a strong, H = 180 koersted, magnetic field was investigated. From the interactions found in an effective length of 2.32 km of tracks, 404 stars with 3 or 4 charged particles were selected because they satisfied the criteria for N N interactions. Secondary tracks were used for measuring the kinematic characteristics of the particle with a precision of 10 to 15%. The above reaction was identified on the basis of 62 stars with π^+ and π^- particles in the final state and 27 pp $\pi^+\pi^-$ type stars. On the basis of experimental data on the scattering of protons by nuclei it was concluded that light particles participate in a great extent in the above reaction. There is a great similarity in the dynamics of the pion ($\pi \rightarrow 3\pi$) and the proton ($p \rightarrow p2\pi$) dissociation in the field of ~20 GeV nuclei; their cross section and resonance indicate that the same mechanism is involved. (TTT)

Strong (Meson-Induced)

1407 (COO-1195-196) K^+p ELASTIC SCATTERING AT 2.53, 2.76, AND 3.20 GeV/c. Whitmore, J.; Abrams, G. S.; Eisenstein, L.; Kim, J.; O'Halloran, T. A. Jr.; Shufeldt, W. (Illinois Univ., Urbana). Aug 1970. Contract AT(11-1)-1195. 49p. Dep. NTIS.

K^+p elastic scattering was studied at incident kaon momenta of 2.53, 2.76 and 3.20 GeV/c in the Argonne 30-in. hydrogen bubble chamber. Differential cross sections are presented for all scattering angles including the backward direction where anomalous behavior is observed in the magnitude and slope of the backward peak in this momentum interval. The forward and backward peaks are compared with Regge models and with previously published data. Results are presented of a partial wave analysis performed at 2.5 GeV/c. While the results are consistent with previous partial wave analyses at lower energies, the data cannot establish the existence of a resonance in the K^+p system. (auth)

1408 (COO-1195-197) STUDY OF THREE PION FINAL STATE INTERACTIONS IN THE REACTION PI MINUS PROTON GOES TO PROTON PI PLUS PI MINUS PI MINUS AT 5 AND 7.5 GeV/c. Brockway, Dennis Vern (Illinois Univ., Urbana. Dept. of Physics). Oct 1970. Contract AT(11-1)-1195. 130p. Dep. NTIS.

Thesis.

A new partial wave analysis is applied to the 3π enhancement between 1.0 to 1.4 GeV in the reaction $\pi^-p \rightarrow p\,\pi^+\pi^-\pi^-$ at 5 and 7.5 GeV/c. This method of analysis allows one to determine the contributions of the different spin parity states to the overall enhancement. The relative importance of the different spin parity states are obtained as a function of 3π mass. It is found that only the 2^+ state shows a definite resonant behavior at a 3π mass of 1305 MeV. This is the well known A_2 meson. The 3π mass region below theA_2 is found to be dominated by the 1_s^+ state, although significant amounts of 0_s^-, 0_p^- and 1_p^+ are also present. We find no evidence for a 1_s^+ state at these energies. The overall features of the spin parity states in the 3π enhancement strongly suggest the interpretation of "Deck" + A_2 for the 3π mass spectra. The polarization of the A_2 meson is found to be consistent with the exchange of a particle of natural parity (ρ^0 or f^0 meson) and the polarization of both halves of the A_2 are found to be the same. (auth)

1409 (JINR-P1-5236) ANALYSIS OF THE HELICITY AMPLITUDES IN REACTIONS $\pi^+p \rightarrow N^*\rho^0$ AND $\pi^+p \rightarrow N^*\omega$ AT 2.34 GeV/c. Gramenitskii, I. M.; Lednicki, R.; Moiseev, A. M.; Prokes, A.; Tikhonova, L. A.; Shafranov, M. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1970. 12p. (In Russian). Dep. NTIS (U. S. Sales Only).

The angular distributions of the resonance decay products in reactions $\pi^+p \rightarrow N^*\rho^0$ and $\pi^+p \rightarrow N^*\omega$ at 2.34 GeV/c were studied. Density matrices for these reactions were expressed in terms of the 12 independent helicity amplitudes. The analysis was made at small scattering angles Θ_s, that corresponds to the small contribution of the amplitudes proportional to $(\sin\Theta_s/2)^n$, where n = 1,2 and 3. The results were compared with the additivity quark model predictions. (auth)

1410 (JINR-P1-5326) INTERACTION OF 60 GeV π^--MESONS WITH NUCLEONS AND NUCLEI. Dalkhazhav, N.; Tolstov, K. D.; Shabratova, G. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1970. 17p. (In Russian). Dep. NTIS (U. S. Sales Only).

The interaction of 60-GeV π^--mesons with nucleons and nuclei was investigated using the photoemulsions enriched with hydrogen and light nuclei (C,O). It is shown that: average multiplicity of charged particles in π^-p-collisions, as an energy function, follows the law $E^{0.35\pm0.04}$; several particles, produced in a primary and π^-N-collision, interact simultaneously with the subsequent nucleon of a nucleus; coherent interactions in photoemulsion are due mainly to Ag and Br nuclei. (auth)

1411 (LAL-1240) MEASUREMENT OF THE RADIATIVE DECAY MODES OF THE ϕ^0 MESON $\phi^0 \rightarrow \eta^0\gamma$, $\phi^0 \rightarrow \pi^0\gamma$ WITH THE ORSAY STORAGE RING. Benaksas, D.; Cosme, G.; Jean-Marie, B.; Jullian, S.; Laplanche, F.; Lefrancois, J.; Liberman, A. D.; Parrour, G.; Repellin, J. P.; Sauvage, G. (Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire). Sep 1970. 14p. (CONF-700806-42). Dep. NTIS (U. S. Sales Only).

From 15th International Conference on High Energy Physics, Kiev, USSR.

A large solid angle detector was used to observe many body final states in the decays of the ϕ^0 meson. In the decay modes $\phi^0 \rightarrow \eta^0\gamma$ and $\phi^0 \rightarrow \pi^0\gamma$, 3$\gamma$ were detected. The data were taken at the peak of the ϕ^0 and the normalization is given by Bhabha scattering. The values found are $B \rightarrow \eta^0\gamma/\phi \rightarrow$ all = 0.020 ± 0.0075, $B \rightarrow \pi^0\gamma/\phi \rightarrow$ all < 0.0024. (auth)

1412 (UCRL-19844) REVIEW OF THE KN AND $\bar{K}N$ TOTAL CROSS SECTIONS BELOW 3.5 GeV/c. Lynch, Gerald (California Univ., Berkeley. Lawrence Radiation Lab.). Jun 1970. Contract W-7405-eng-48. 38p. (CONF-700416-10). Dep. NTIS.

From International Conference on Hyperon Resonances, Durham, N. C.

The K^+ and K^- total cross sections from 0.4 to 3.4 GeV/c and the derived cross sections in the I = 0 and I = 1 channels are presented in such a way that one can determine how well the different experiments agree concerning various features of the data and to what extent some of the conclusions are doubtful from uncertainties introduced during the analysis. (J.F.P.)

1413 (UCRL-20076) K^{*0} PRODUCTION IN K^+d INTERACTIONS AT 12 GeV/c. Firestone, A.; Goldhaber, G.; Lissauer, D. (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 17p. (CONF-700806-46). Dep. NTIS.

From 15th International Conference on High Energy Physics, Kiev, USSR.

Preliminary results are reported on $K^+ + n \rightarrow K^+ + \pi^- + p$ and $K^+ + n \rightarrow K^0 + \pi^+ + \pi^- + p$ interactions at 12 GeV/c in a deuterium bubble chamber. In the first reaction several N^* resonances and K^*(890) and K^*(1420) and also the K^*(1250) is found. There was also a signal at 1360 with $J^P \neq 2^+$ observed. In the second reaction only the K^*(1420) is seen. (J.F.P.)

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1414 (UH-511-77-70) OBSERVATION OF A 2400-MeV 5π MASS ENHANCEMENT IN 6-PRONG π^-p EVENTS AT 12 GeV/c. Johnson, A. D.; Peters, M. W.; Stenger, V. J.; Yee, A. (Hawaii Univ., Honolulu). Aug 1970. Contract AT(04-3)-511. 9p. (CONF-700806-47). Dep. NTIS.

From 15th International Conference on High Energy Physics, Kiev, USSR.

An enhancement centered at M = 2420 ± 25 MeV is observed in six-prong π^- + p interactions at 12 GeV/c in a hydrogen bubble chamber. The width of this enhancement and the branching ratio for the $\rho\rho\pi$ decay mode were determined. Also the $\Delta^{++}(1236)$ and $\rho^0(765)$ resonance production were observed. (J.F.P.)

1415 K^+p INTERACTIONS IN THE RANGE 0.9 TO 1.5 GeV/c AND ELASTIC SCATTERING PHASE SHIFT ANALYSIS. Giacomelli, G. (Univ., Bologna); Lugaresi-Serra, P.; Mandrioli, G.; (and others). Nucl. Phys.; B20: 301-19(1970).

. A bubble chamber experiment is described in which observations were made of the elastic and inelastic interactions of positive kaons with protons. Total elastic and inelastic cross sections, partial inelastic cross sections and elastic-scattering angular distributions are given at 9 kaon momenta in the range 0.9 to 1.5 GeV/c. A phase shift analysis of the elastic channel is presented using these data in combination with previous data and recent polarization data. (auth)

1416 STUDY OF IMPULSE MODEL IN REACTION $K^-d \rightarrow p\Lambda^0\pi^-$ + NEUTRALS. Tebes, J.; Carmony, D. D.; Garfinkel, A. F.; Gutay, L. J.; Miller, D. H. (Purdue Univ., Lafayette, Ind.). Nucl. Phys.; B20: 565-72(1970).

In an analysis of 1114 events of the type $K^-d \rightarrow p\Lambda^0\pi^-$ + neutrals with "spectator" proton momentum in excess of 0.11 GeV/c, it is found that the number of protons having a momentum in the range 0.25 to 1.2 GeV/c exceeds that predicted on the basis of the impulse model using the Hulthén distribution by 3:1. Final-state interactions in which the proton does not form resonances with the other final-state particles are mainly held responsible for this effect. (auth)

1417 STUDY OF THE REACTION $\pi^+d \rightarrow$ pp FOR PION ENERGIES BETWEEN 142 AND 262 MeV. Richard-Serre, C.; Hirt, W.; Measday, D. F.; (and others) (CERN, Geneva). Nucl. Phys.; B20: 413-40(1970).

The differential cross section for the reaction $\pi^+d \rightarrow$ pp was measured at pion laboratory energies of 142, 165, 187, 230 and 262 MeV. The angular distribution in the c.m. was expressed in the form $K(A + \cos^2\theta - B\cos^4\theta)$. For the first time in this energy region the results are sufficiently precise to require the $\cos^4\theta$ term. Low energy measurements ($\eta \leq 2.0$) of this reaction and the time reverse reaction were re-analyzed and it was found that the total cross section in mb for the reaction pp $\rightarrow \pi^+$d can be expressed as $(0.18 \pm 0.02)\,\eta + (0.95 \pm 0.15)\,\eta^3$ where η is the pion momentum in the c.m. system in units of $m_\pi c$. (auth)

1418 REACTION $K^-p \rightarrow \Lambda\pi^0$ IN THE c.m. ENERGY RANGE 1915 TO 2168 MeV. Berthon, A. (College de France, Paris); Rangan, L. K.; Vrana, J.; (and others). Nucl. Phys.; B20: 476-92(1970).

A formation study of the reaction $K^-p \rightarrow \Lambda\pi^0$ at 13 c.m. energies between 1915 and 2168 MeV is presented. Experimental differential cross sections and polarizations are given as expansions of Legendre polynomials and associated Legendre polynomials respectively. Partial wave analysis confirms the $\frac{1}{2}^+$ assignment of the $\Sigma(2030)$ and the $\frac{5}{2}^+$ assignment of the $\Sigma(1915)$. The parameters of these resonances are determined. The possible existence of other resonances coupled to this channel is investigated. (auth)

1419 OBSERVATIONS OF Σ HYPERONIC ATOMS. Backenstoss, G. (Univ., Karlsruhe, Ger. Kernforschungszentrum, Karlsruhe, Ger.); Bunaciu, T.; Charalambus, S.; (and others). Phys, Lett.; 33B: 230-2(12 Oct 1970).

Clear evidence for the observation of Σ^- atoms is presented, based on a series of Σ atomic x-ray lines in three target elements. X-ray energies and the number of Σ atoms produced per stopped K^- meson agree with expectations. (auth)

1420 $2\pi^0$ MASS SPECTRUM AND $\delta\beta$ FROM π^- + p $\rightarrow \pi^0 + \pi^0$ + n AT 10 GeV/c. Shibata, E. L.; Frisch, D. H.; Wahlig, M. A. (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Lett.; 25: 1227-31(26 Oct 1970).

An enhancement in the $2\pi^0$ mass spectrum in the region $M_{\pi\pi} <$ 1 GeV was observed in π^- + p $\rightarrow \pi^0 + \pi^0$ + n at 10 GeV/c. This is interpreted as a broad isospin-0, s-wave resonance at 600 ± 100 MeV with width 400 ± 100 MeV. Because of limited mass resolution, one cannot rule out several narrower resonances with these quantum numbers. (auth)

1421 STUDY OF THE I = 0 $\pi^-\pi^+$ ENHANCEMENT IN THE 1.07 GeV MASS REGION. Reynolds, B. G. (Ohio Univ., Athens); Huwe, D. O.; Albright, J. R.; (and others). Nucl. Phys.; B21: 77-87(1970).

The $\pi^+\pi^-$ effective mass distribution in π^-p experiments at 2.26 and 2.36 GeV/c was analyzed and the existence of a $\pi^-\pi^+$ mass enhancement at 1.07 ± 0.02 GeV with a width ranging from 50 MeV to 120 MeV was confirmed depending on the choice of cuts on momentum transfer and decay angle. It is found that the enhancement is particularly strong when produced at these momenta; however, although it is found that many of its properties are consistent with it being the ππ decay mode of the $\eta_{0+}(1060)$, the possibility that it is a new I = 2 resonance cannot be ruled out. (auth)

1422 K^-p CROSS SECTIONS FROM 440 TO 800 MeV/c. Armenteros, R. (CERN, Geneva); Baillon, P.; Bricman, C.; (and others). Nucl. Phys.; B21: 15-76(1970).

K^-p reactions were studied at 19 different momenta between 436 and 793 MeV/c. This interval corresponds to a mass of the $\bar{K}N$ system from 1535 to 1695 MeV. About 400,000 photographs were taken in the 81 cm Saclay hydrogen bubble chamber exposed to a separated K^- beam at the CERN proton-synchrotron. A total of about 100,000 events was analyzed, from which partial and differential cross sections were determined. Polarizations were obtained for the two-body reactions where the decay of the Λ or Σ hyperon allowed their measurement. Data for all the channels are presented here. (auth)

1423 BARYON EXCHANGE IN THE REACTION $K^-p \rightarrow \Lambda\omega$ AND $K^-n \rightarrow \Sigma\omega$ AT 3 GeV/c AND $\Lambda\bar{N}K$ AND $\Sigma\bar{N}K$ COUPLING CONSTANTS. Hoogland, W. (Zeeman-Laboratorium, Amsterdam); Kluyver, J. C.; Massaro, G. G. G.; (and others). Nucl. Phys.; B21: 381-7(1970).

Differential cross sections are presented for the reactions $K^-p \rightarrow \Lambda\omega$, $K^-p \rightarrow \Lambda\varphi$, $K^-n \rightarrow \Sigma^-\omega$ and $K^-N \rightarrow \Sigma^-\varphi$ at 3 GeV/c incident momentum. Significant backward peaks are observed in the reactions giving ω-meson production in contrast to the reactions with φ-meson production. The assumption that the backward peaks observed are due to nucleon exchange leads to a ratio of the coupling constants $g^2_{\Sigma NK}/g^2_{\Lambda NK}$ which is in disagreement with the prediction of SU(6) for this ratio. (auth)

1424 APPLICATION OF THE GENERALIZED VENEZIANO MODEL TO THE REACTION $K^-n \rightarrow K^{*-}\pi^-p$ AT 4.5 GeV/c. Paler, K. (Purdue Univ., Lafayette, Ind.); Amman, A. C.; Carmony, D. D.; (and others). Nucl. Phys.; B21: 407-12(1970).

A phenomenological calculation is made for the reaction $K^-n \rightarrow K^{*-}\pi^-p$, at 4.5 GeV/c, using a five-point Veneziano amplitude. Reasonable agreement is obtained for the two-body effective-mass spectra but the single-particle c.m. angular distributions are less well described. (auth)

1425 STUDY OF THE REACTION $\pi^+p \rightarrow Y_1^{*+}(1385)K^+$ AT 1.7 GeV/c. Pan, Yu-li; Forman, Fred L. (Univ. of Pennsylvania, Philadelphia). Nucl. Phys.; B21: 395-406(1970).

Data on the quasi-two-body reaction $\pi^+p \rightarrow Y_1^{*+}(1385)K^+$ ($Y_1^{*+}(1385) \rightarrow \Lambda^0\pi^+$) at 1.7 GeV/c are presented. Within the $\Lambda^0\pi^+$ mass-square range 1.81 to 2.01 GeV^2 (1.346 to 1.419 GeV) approximately 600 events with about 10% background were obtained. The cross section for this channel is 110 ± 20 μb. The results were compared to various vector-dominance models and indicate deviations from the Stodolsky–Sakurai model. (auth)

1426 STUDY OF THE DIFFERENTIAL CROSS SECTIONS $d\sigma/dt$ FOR THE REACTIONS $\pi^-p \rightarrow \pi^-p$, $\pi^+\pi^-n$ AND $\pi^-\pi^0p$ AT 2.77 GeV/c. Baton, J. P.; Laurens, G. (CEN, Saclay, France). Nucl. Phys.; B21: 551-67(1970).

In the reaction $\pi^-p \rightarrow \pi^-p$ and $\pi^-p \rightarrow \pi\pi N$ at 2.77 GeV/c 58.650, two prong events were analyzed. The production cross sections, and the differential cross sections $d\sigma/dt$ are presented. Some prominent features were observed in the t_N and t_Δ distributions. Δ^- production in the forward direction is observed. Finally the difficulties to explain the behavior of the forward and backward distribution in the three-body final-state reactions are discussed. (auth)

1427 POLARIZATION IN ELASTIC K^-p SCATTERING AT SIX MOMENTA BETWEEN 982 MeV/c AND 1732 MeV/c. Andersson-Almehed, S.; Daum, C.; Erne, F. C.; Lagnaux, J. P.; Sens, J. C.; Udo, F. (CERN, Geneva). Nucl. Phys.; B21: 515-27 (1970).

Polarization and differential cross-section data are presented at 982, 1082, 1142, 1212, 1282 and 1732 MeV/c. (auth)

Particle Interactions and Properties (Theoretical)

Refer also to abstract 1776.

1428 EQUAL STRENGTHS FOR SECOND- AND FIRST-ORDER ELECTROMAGNETIC AND WEAK PROCESSES. Griffith, Richard W. (Argonne National Lab., Ill.). Phys. Rev., D; 2: 1732-7(15 Oct 1970).

The possibility is discussed of a "second-order" unitarity contribution which can be at least comparable to the conventional "first-order" term for high-energy, large-momentum-transfer lepton-hadron elastic scattering. A crucial ingredient is a recent diffraction model for virtual-current, hadron elastic scattering. A crucial ingredient is a recent diffraction model for virtual-current, hadron elastic scattering in which the diffraction peak broadens with increasing virtual mass. (auth)

General

Refer also to abstracts 1355 and 1356.

1429 (AD-706920) RESEARCH ON ELEMENTARY PARTICLES. Final Scientific Report, November 1968–September 1969. Salam, Abdus; Matthews, P. T. (Imperial Coll. of Science and Technology, London (England). Dept. of Physics). 3 Feb 1970. 10p. (AFOSR-70-1488-TR). NTIS.

The research work described covers a large number of topics in the general field of theoretical elementary particle physics, including in particular Regge pole theory, current algebra, strong interaction dynamics and astrophysics. (auth)

1430 (IFVE-STF-69-110). ON THE EQUALITY OF THE TOTAL CROSS SECTIONS FOR THE INTERACTION OF PARTICLES AND ANTIPARTICLES AT HIGH ENERGIES. Volkov, G. G. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1969. 11p. (In Russian). Dep. NTIS (U. S. Sales Only).

Physical conditions of violation and fulfillment of the Pomeranchuk theorem are presented. (auth)

1431 KINEMATICS OF MANY-PARTICLE PROCESSES IN INVARIANT VARIABLES: PHYSICAL REGIONS, PHASE SPACE, AND ALL THAT. Poon, C. H. (Univ. of California, San Diego, La Jolla). Nucl. Phys.; B20: 509-52(1970).

The kinematics of processes involving N spinless particles, in terms of invariant variables, are studied by means of Gram determinants. It is proposed that the Gram determinant method may provide a convenient unified treatment for general kinematical purposes. Using this approach, the necessary and sufficient conditions for describing the physical regions are obtained; their solutions produce a systematic, practical scheme for constructing the physical regions explicitly. Secondly, a simple way of obtaining relations between geometrical and invariant quantities is described; some such relations are exhibited. The application of the Gram-determinant method is illustrated mainly with a discussion on the Toller angle dependence of the reggeon–reggeon–particle vertex function; in particular, a certain form of such dependence, in the asymptotic Regge limit, that arises naturally from the internal consistency of multi-Reggeism is found. Finally, the phase-space factor for many-particle productions is discussed. (auth)

1432 POLYNOMIAL ALGEBRAS. Raghavacharyulu, I. V. V.; Menon, Nalini B. (MATSCIENCE, Madras). J. Math. Phys. (N. Y.); 11: 3055-60(Oct 1970).

Polynomial algebras are discussed as an extension of previous work on the algebras of matrices satisfying conditions like $L^m = I$ and $L^m = L^k$. Assuming L_m to be an m-dimensional linear space, a class of associative algebras called polynomial algebras is generated by requiring that every element L of L_m satisfy a polynomial equation $L^n + P_1 L^{n-1} + \cdots + P_n = 0$. It is shown that some very important algebras, which were found useful, can be obtained by various restrictions on the polynomial. A few general properties of these algebras are established. (auth)

1433 INTRODUCTION A L'ETUDE DES PARTICULES ELEMENTAIRES. (Introduction to Elementary Particle Study). Omnes, Roland. Paris; Ediscience (1970). 438p.

Some fundamental notions and theoretical ideas on what constitutes a particle and how its fundamental characteristics are determined were presented. An overall survey of the ideas and the research which form the basis of particle physics is offered to the nonspecialist physicist: electrodynamics, strong interactions, weak interactions, field theory, high energy phenomena and group invariance. (France)

1434 PARAPARTICLES OF INFINITE ORDER. Hartle, James B. (Univ. of California, Santa Barbara); Stolt, Robert H.; Taylor, John R. Phys. Rev., D; 2: 1759-60(15 Oct 1970).

It is shown that with one exception every possible statistical type of particle consistent with the cluster properties of quantum mechanics can be uniquely identified by a single pair of integers (p,q). A particle of type (p,q) has states corresponding to all Young diagrams whose first p columns (and only these) have arbitrary depth and whose first q rows (and only these) have arbitrary length. Parabosons and parafermions of order p are included in this scheme as types (0,p) and (p,0), respectively. If p and q are nonzero, then the particle is of infinite order. The only exception to this classification scheme is a particle with states corresponding to all Young diagrams. (auth)

1435 HIDDEN-VARIABLE EXAMPLE BASED UPON DATA REJECTION. Pearle, Philip M. (Hamilton Coll., Clinton, N. Y.). Phys. Rev., D; 2: 1418-25(15 Oct 1970).

A deterministic local hidden-variable model is presented which describes the simultaneous measurement of the spins of two spin-$\frac{1}{2}$ particles which emerged from the decay of a spin-zero particle. In this model the measurement of the spin of a particle has one of three possible outcomes: spin parallel to the apparatus axis, spin antiparallel to the apparatus axis, or the particle goes undetected. It is shown that agreement with the predictions of quantum theory is obtained provided the experimenter rejects the "anomalous" data in which only one particle is detected. A reasonably model-independent lower bound to the fraction of undetected particles is also computed: It is found that in 14% of the decays or more, one or both of the particles will go undetected. (auth)

1436 LOW-MOMENTUM-TRANSFER PREDICTIONS OF THE COLLINEARIZED CURRENT ALGEBRA. Kazes, Emil (Pennsylvania State Univ., University Park). Phys. Rev., D; 2: 1708-11(15 Oct 1970).

The low-momentum-transfer predictions of the collinearized current algebra at $p = \infty$ are investigated. The study is greatly facilitated by combining the Dashen–Gell-Mann angular conditions with current algebra in order to obtain a difference equation for the dipole-moment operator. In the resonance approximation an elementary solution is obtained. (auth)

1437 COMPOSITE STATES FOR FOUR-FERMION INTERACTIONS BY THE METHOD OF BROKEN SYMMETRIES. Mueller, Harald J. W. (Univ., Munich). Z. Naturforsch.; 25a: 1017-24(Jul 1970).

Composite states of quasiparticles are studied in the frame of Bopp's quantum theory of elementary particles in a lattice space. By solving the homogeneous Bethe–Salpeter equations in the combined chain and ladder approximation, the theory is found to contain a massless pseudoscalar particle (the Goldstone boson), a scalar particle of mass 2 m and an axialvector particle of mass $2\,m - d$, $d > 0$, where m is the mass of the quasiparticles and d a small quantity depending on the number of lattice points (or equivalently the cutoff). The method of summation of chain and ladder diagrams by means of the Fierz formula is treated in some detail. Analogies with the model of Nambu and Jona–Lasinio are pointed out. Finally some remarks on the scattering problem are added. (auth)

Electromagnetic

Refer also to abstracts 982, 1361, 1598, 1620, and 1707.

1438 (AD-706834) BREAKDOWN OF SCALING INVARIANCE IN THE GENERALIZED BJORKEN LIMIT OF PERTURBATION THEORY. Haberler, P. L. F.; Lipshutz, N. R.; Weaver, O. L. (Duke Univ., Durham, N. C. Dept. of Physics). 1970. 12p. NTIS.

The cross sections for meson electroproduction are examined in two model field theories. It is found that for the interaction of neutral scalar mesons with nucleons the structure functions exhibit scaling in the generalized Bjorken limit, but that for the case of the charge independent pseudoscalar meson–nucleon interaction, scaling does not always occur. The origin of this breakdown and its significance for parton models of deeply inelastic electron–hadron scattering are discussed. (auth)

1439 (BNL-tr-372) NEUTRON-ELECTRON INTERACTION. Aleksandrov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). Translated by S. J. Amoretty (Brookhaven National Lab., Upton, N. Y.), from report JINR-P3-4783. 22p. Dep. NTIS.

This review of the electron–neutron interaction covers the experimental techniques for determining the neutron–electron interaction, theoretical analysis of the interaction, and a study of this interaction using neutron diffraction by a single crystal of tungsten. (J.F.P.)

1440 (DESY-70/44) ANNIHILATION OF ELECTRON-POSITRON PAIRS INTO MESONS. Kramer, G.; Uretsky, J. L.; Walsh, T. F. (Deutsches Elektronen-Synchrotron, Hamburg

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(West Germany)). Sep 1970. 18p. Dep. NTIS (U. S. Sales Only).

Hadronic cross sections for e^+e^- annihilation in the multi-GeV energy region are estimated. The model invokes ρ dominance and the known couplings of the physical ρ-meson to resonances. It is concluded that the cross section at 2-GeV total energy could be comparable to the cross section for producing $\mu^+\mu^-$ pairs. An attempt is also made to estimate a cross section from the statistical model of Bjorken and Brodsky. (auth)

1441 (IFVE-SVM-70-2) PHOTOPRODUCTION OF W-MESON-ELECTRON PAIRS. Kompaneets, V. G. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1970. 16p. (In Russian). Dep. NTIS (U. S. Sales Only).

The analytical expression for the photoproduction cross section of W-meson-electron up to the double integral on invariance variables for the values of the anomalous momentum of meson 0 ± 1 is obtained. The analysis of the threshold and asymptotic cross section is given. (auth)

1442 (ITF-70-40) CONNECTION OF NEUTRAL VECTOR MESONS PHOTOPRODUCTION ON THE NUCLEI WITH THE PROCESSES OF π- AND K-MESON INTERACTION WITH NUCLEI. Rekalo, M. P. (Akademiya Nauk Ukrainskoi SSR, Kiev. Institut Teoreticheskoi Fiziki). 1970. 13p. (In Russian). Dep. NTIS (U. S. Sales Only).

The relations between the differential cross sections of the neutral vector mesons photoproduction on nuclei at $t = 0$ and the total cross sections of π and K meson interactions with nuclei are found in the quark model. These relations predict then the A dependence of the differential cross sections of the V^0 photoproduction on the nuclei that agrees well with experimental data for the reaction $\gamma + A \to A + \rho^0$. The vector dominance hypothesis gives the possibility of obtaining the absolute values of dG/dt ($\gamma d \to d\rho$) that do not contradict existing experimental data. It is shown that the t dependence of the differential cross sections of the processes $\gamma + d \to d + \rho^0$ and $\pi + d \to \pi + d$ must be equal. (auth)

1443 (ITF-70-41) NEUTRAL VECTOR MESONS PHOTOPRODUCTION PROCESSES IN QUARK MODEL: SU(3)-STRUCTURE OF ELECTROMAGNETIC CURRENT AND RELATIONS BETWEEN THE DIFFERENTIAL CROSS SECTIONS. Rekalo, M. P. (Akademiya Nauk Ukrainskoi SSR, Kiev. Institut Teoreticheskoi Fiziki). 1970. 16p. (In Russian). Dep. NTIS (U. S. Sales Only).

Different consequences of the quark model for neutral vector meson photoproduction processes are investigated. It is shown that the relations between the differential cross sections of the processes $\gamma + N \to N + V^0$ at $t = 0$ are very sensitive to a relative value of a possible singlet component of the hadron electromagnetic current. Existing experimental data agree well with the hypothesis of the octet nature of the electromagnetic current. It is shown also that the differential cross sections of the processes $\gamma + N \to N + V^0$ at $t \neq 0$ may be connected with differential cross sections of different meson–baryon scattering reactions without any additive assumptions about the quark amplitudes (such, for example, as the validity of the definite relations between quark amplitudes or the possibility of neglecting real parts of the elastic meson–baryon scattering amplitudes with respect to their imaginary parts). (auth)

1444 (JINR-E2-5225) RELATIVISTIC QUASIPOTENTIAL EQUATIONS IN THE CASE OF ELECTROMAGNETIC INTERACTION. Ilchev, A. S.; Mateev, M. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1970. 23p. Dep. NTIS (U. S. Sales Only).

The quasipotential approach is applied to the systems of particles which interact electromagnetically. Two basic scattering processes—electron-positron and Compton scattering are described in detail. (auth)

1445 ELECTRIC DIPOLE MOMENT OF THE NEUTRON AND ELECTROMAGNETIC T-VIOLATION. Broadhurst, D. J. (Univ. of Sussex, Eng.). Nucl. Phys.; B20: 603-14(1970).

A calculation of the neutron electric dipole moment, assuming a threshold dominated, unsubstracted sideways dispersion relation, yields the result 4×10^{-23} sin $\theta_\Delta$cm, with θ_Δ the T non-invariant phase at the vertex $\Delta(1236)p\gamma$. Other calculations are reported giving contributions an order of magnitude smaller and an estimate is made of the effect of direct-channel resonance enhancement. (auth)

1446 REGGE-POLE DESCRIPTION OF $\gamma N \to \pi N$ BACKWARD-SCATTERING DATA. Barger, V.; Weiler, P. (Univ. of Wisconsin, Madison). Nucl. Phys.; B20: 615-28(1970).

Baryon Regge-pole contributions to u-channel helicity amplitudes for the $\gamma N \to \pi N$ processes are derived, with attention to kinematic singularities and threshold conditions. An N_α, N_γ and Δ_δ Regge-exchange model is proposed that describes the backward scattering data on $\gamma p \to \pi^0 p$ and $\gamma p \to \pi^+ n$ at high energy. The N_α and N_γ trajectories are found to be nearly degenerate, with residues in the ratio $\beta(N_\gamma)/\beta(N_\alpha) \approx 0.6$. Structure in the differential cross sections is explained as $I_u = 1/2$ dominance at small u giving way to $I_u = 3/2$ dominance at large u. An isoscalar-isovector admixture for the γ-coupling to $\overline{N}N$ is required by the fits. The solution extrapolates through the mean $\gamma p \to \pi^0 p$ 180° differential cross section at intermediate energies, as required by duality. (auth)

1447 KAON AND PION CHARGE RADII AND THE MAGNETIC MOMENTS OF rho AND K* FROM SIDEWISE DISPERSION RELATIONS. Tan, Tat Shong; Stoler, David (Polytechnic Inst. of Brooklyn). Nucl. Phys.; B20: 405-12(1970).

The charge radii of the kaon and pion were calculated by means of sidewise dispersion relations. In the calculation the two radii are approximately the same in agreement with SU(3). The calculation also leads to a sum rule from which a prediction of the magnetic moments of the ρ and K* mesons is obtained. (auth)

1448 CHARGED PION PHOTOPRODUCTION IN THE QUARK MODEL. Barbour, I.; Moorhouse, R. G. (Univ. of Glasgow). Nucl. Phys.; B20: 629-36(1970).

In terms of a quark model an explanation is given of charged pion photoproduction ratios, at small momentum transfer, in the processes $\gamma N \to \pi^+ N$, $\gamma N \to \pi^+ \Delta$. The model is also shown to be consistent with π^0 photoproduction data. (auth)

1449 EXTRAPOLATION OF THE PROTON FORM FACTOR INTO THE TIMELIKE REGION. Pfister, H. (Univ., Tuebingen, Ger.). Nucl. Phys.; B20: 320-6(1970).

An extrapolation method for amplitudes with only one cut is presented, which is based on an explicit inversion of the dispersion integral. It is compared with the so called optimal extrapolation procedure of Ciulli and Cutkosky. The numerical application of the method to the proton form factor yields an imaginary part in the timelike region, which has a zero in the mass region between 840 MeV and 970 MeV, and shows no peak in the region of the ρ-meson. (auth)

1450 MULTIPHOTON BREMSSTRAHLUNG. Nadzhafov, I. M. (Moscow State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 1, 136-8(1970). (In Russian).

Processes of two-, three-, and four-photon bremsstrahlung of electrons in a Coulomb field of nuclei were studied considering electron and γ-quantum polarization and various regularities in the processes. Data obtained showed that charged particles scattering in Coulomb field at small angles emitted an even number of photons. In the case of emission of an even number of photons the initial electron polarization during scattering process does not undergo any changes while pairs of photons acquired inverse-circular polarization. (R.V.J.)

1451 FLUID-DYNAMIC APPROACH TO MASS OF CLASSICAL ELECTRON. Kaufman, H. R. (Lewis Research Center, Cleveland). Phys. Lett.; 33A: 9-10(21 Sep 1970).

A fluid-dynamic flow-process evaluation gives the Abraham–Lorentz value of $\frac{4}{3}$ m_e for the electric field alone, and the inclusion of electron-body flow work makes the entire mass Lorentz invariant. A nonflow evaluation also gives the correct mass. (auth)

1452 POLARIZATION DEPENDENCE OF ELASTIC LEPTON (ANTILEPTON) NUCLEON ELECTROMAGNETIC SCATTERING. Kerimov, B. K.; Takwale, R. G. (Moscow State Univ.). Indian J. Pure Appl. Phys.; 6: 58-61(Mar 1968).

A general expression for the differential cross section of elastic scattering of leptons (electrons and μ^--mesons) and antileptons (positrons and μ^+-mesons) on a proton target was obtained by taking into account spin vectors of the particles in the initial and final states and also the mass of the lepton and antilepton. The cross section obtained in the laboratory system was expressed in terms of charge and magnetic form factors. The formula is used to investigate angular distribution of the degree of polarizations. In the case of scattering of unpolarized leptons by polarized proton target, scattered leptons get polarized, degree of transverse polarization being proportional to the mass of lepton. In the scattering of longitudinally polarized beam by unpolarized proton target, the recoil protons, which are scattered in the direction of incident leptons, are completely longitudinally polarized. (auth)

1453 ONE-PHOTON AND TWO-PHOTON PHOTOPION PRODUCTION. Prakash, Hari; Vachaspati (Univ. of Allahabad, India). Indian J. Pure Appl. Phys.; 6: 155-60(Mar 1968).

The phenomena of one-photon and two-photon positive, negative and neutral photo-pion productions were studied by the perturba-

tion theory, treating the nucleons and pions as the nonrelativistic Schrödinger and scalar Klein-Gordon particles respectively. Variation of the cross sections of these processes is discussed. When the initial nucleon is taken to be at rest it is found that the cross sections of the one-photon charged photo-pion production and two-photon charged and neutral photo-pion productions are zero before and at some threshold values of the photon energy. On increasing the photon energy, they increase from zero to maximum values and then tend to zero asymptotically. The cross section of one-photon photo-pion, however, increases from zero at the threshold value tending asymptotically to a nonzero value. (auth)

1454 MASS-DISPERSION RELATIONS AND ASYMPTOTIC CONSTRAINTS ON FORM FACTORS. Murtaza, G.; Razmi, M. S. K. (Univ. of Islamabad, Rawalpindi, Pakistan). Phys. Rev., D; 2: 1702-8(15 Oct 1970).

The mass extrapolation procedure of Fubini and Furlan and of de Alfaro and Rossetti, together with current algebra and partial conservation of axial-vector current, is used to derive asymptotic relations between the vector and axial-vector form factors of the nucleon. These relations are compared with the ones obtained recently by Gordon and Peccei. The nonrenormalization of the axial-vector coupling constant is obtained, provided that the time derivative of the divergence of axial-vector current. (auth)

1455 ATOMIC PROCESSES INVOLVED IN MATTER–ANTIMATTER ANNIHILATION. Morgan, David L. Jr.; Hughes, Vernon W. (Yale Univ., New Haven). Phys. Rev., D; 2: 1389-99(15 Oct 1970).

Atomic processes are important in determining the particle-antiparticle annihilation rates in the matter-antimatter interaction. Consideration of these processes is given for a hydrogen-antihydrogen mixture. The atomic effects considered are the effect of the Coulomb field on the direct annihilations, radiative capture, and rearrangement collisions. Radiative capture and rearrangement reactions lead to particle-antiparticle bound states from which annihilation proceeds. The rearrangement cross sections are considerably greater than the direct-annihilation cross sections and therefore lead to a large increase in the total annihilation rates over a wide range of kinetic energies. The lifetimes of two types of hydrogen-antihydrogen mixtures are calculated and are found to differ significantly from the results obtained by others. (auth)

1456 TWO DIMENSIONAL CALCULATIONS OF THE ENERGY DENSITY DISTRIBUTION IN TIN FROM AN 8 GeV PION BEAM. O'Brien, K. (Atomic Energy Commission, New York). Nucl. Instrum. Methods; 86: 217-20(1970).

A linear internuclear nucleonic cascade code has been extended to two dimensions and applied to the calculation of energy deposition in tin from an 8 GeV pion beam. Comparison of the calculated results with measurements carried out at the Stanford Linear Accelerator illustrates the importance of accounting for detector size. Except for a peak in the experimental data on the beam axis and near to the point of entry of the beam, agreement between measurements and calculations is good. (auth)

1457 RELATION BETWEEN THE RENORMALIZED ELECTRON MASS AND CHARGE AND THE BARE MASS AND CHARGE IN THE $\alpha(\alpha L)^n$ APPROXIMATION. Fomin, P. I.; Truten, V. I. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 59: 890-7(Sep 1970). (In Russian).

The relation between the renormalized electron mass and charge, m and α, and the bare values m_0, α_0 and the cut-off parameter Λ is found by taking into account the contribution of the $\alpha(\alpha L)^n$ approximation which follows after the Landau, Arbrikosov, Khalatnikov "senior-logarithmic" or $(\alpha L)^n$ approximation. The nature of the divergences of the electron self-energy and vacuum polarization, the "superconducting" solution in quantum electrodynamics, and the fictitious pole of the Green photon function are analyzed on basis of the relations obtained. (auth)

1458 STATISTICAL SCATTER OF ENERGY LOSSES BY LOW-ENERGY CHARGED PARTICLES. Kessel'man, V. S. Zh. Eksp. Teor. Fiz.; 59: 834-44(Sep 1970). (In Russian).

The distribution function for energy losses by low-energy particles traversing a "thin layer of matter" (for which the losses are appreciably smaller than the initial particle energy) is determined by taking into account multiple scattering. (auth)

1459 POSITRON PRODUCTION IN A COULOMB FIELD WITH Z > 137. Popov, V. S. Zh. Eksp. Teor. Fiz.; 59: 965-84(Sep 1970). (In Russian).

Spontaneous production of positrons in a strong coulomb field with $Z > Z_{cr}$ is considered, where Z_{cr} is the "critical" value of the nuclear charge (for $Z = Z_{cr}$ the energy of $1S_{\frac{1}{2}}$ ground state reaches the limit of the lower continuum $\epsilon = -mc^2$; the value of Z_{cr} always exceeds 137 and depends on the cut-off radius R and, to a less degree, on the nature of the electric charge distribution over the nuclear volume). It is shown that at the threshold (i.e., for $(Z - Z_{cr}) \ll Z_{cr}$) the probability for spontaneous positron creation vanishes exponentially. It is important for the analysis that for $\epsilon = -mc^2$ the electron state remains localized at distances of the order of $\hbar/mc$ from the nucleus (m is the electron mass). In this respect this case sharply differs from the usual nonrelativistic situation with $\epsilon \to +mc^2$. This is a characteristic property of the relativistic coulomb problem and can be understood already in the particular case of the Klein–Gordon equation. Spontaneous pair production in a short-range rectangular well type of potential is also discussed. (auth)

1460 MASS OF THE VECTOR-MESON AND THE SLOPE OF THE FORWARD DIFFERENTIAL CROSS SECTION IN THE PHOTO-PRODUCTION PROCESS. Yoshii, Hiroaki (Tokyo Inst. of Tech.). Nucl. Phys.; B21: 388-94(1970).

A simple model is given, which explains the variation of the slope of the small angle differential cross section as the mass of one of the "bodies" (external mass) varies, utilizing the method removing the kinematical singularities and zeros from helicity amplitudes. From this model the mass shift of the ρ^0 meson produced in the process $\gamma + p \to \rho^0 + p$ is predicted and $(d\sigma/dt)\ (\gamma p \to \varphi p) \simeq 3.5 \exp(3 \sim 6)\ t\ \mu b/GeV^2$. The agreement of these predictions with experimental data is fairly good. (auth)

1461 SMALL-u DIFFERENTIAL CROSS-SECTION IN π^- PHOTOPRODUCTION. Bajpai, R. P. (Univ. of Manchester, Eng.). Lett. Nuovo Cim.; 4: 754-6(17 Oct 1970).

It is pointed out that for a very wide class of Regge exchange models it is possible to obtain the same conclusions about the 180° π^- photoproduction differential cross sections. The processes $\gamma + p \to \pi^0 + p$, $\gamma + p \to \pi^+ + n$, and $\gamma + n \to \pi^- + p$ are considered. (J.F.P.)

1462 COHERENT PION PHOTOPRODUCTION IN DEUTERIUM AND ^{3}He. Julius, D. L. (Univ., Karlsruhe, Ger.). Nucl. Phys.; B21: 173-91(1970).

The coherent reactions $\gamma + d \to \pi^0 + d$ and $\gamma + {}^3He \to \pi^+ + {}^3H$ are studied in the Glauber model with the full spin structure of the CGLN photoproduction amplitudes taken into account. Intermediate states containing vector mesons are included in the analysis and special difficulties associated with the Primakoff effect and one-pion-exchange graphs are examined. In the latter case it is shown that the magnitude of the Glauber correction is seriously underestimated in older treatments in which one-pion-exchange contributions are not isolated explicitly. (auth)

1463 NEUTRON–PROTON BREMSSTRAHLUNG CALCULATED WITH POTENTIALS: AGREEMENT WITH EXPERIMENT. Brown, V. R. (Univ. of California, Livermore). Phys. Lett.; 32B: 259-62(6 Jul 1970).

Neutron-proton bremsstrahlung is calculated with the Bryan-Scott and the Hamada-Johnston potentials. Quantitative agreement with an existing experiment is obtained. The calculation includes rescattering but is not completely gauge invariant because of the momentum dependence and exchange character of the nuclear potentials. (auth)

1464 PION ELECTROPRODUCTION AND CHOICE OF FRAME IN THE VECTOR MESON-DOMINANCE MODEL. Iso, C.; Schildknecht, D. (Deutsches Elektronen-Synchrotron, Hamburg. American Univ., Beirut). Nucl. Phys.; B21: 242-52(1970).

It is pointed out, how forthcoming experiments on electroproduction of pions will provide additional information on the choice of the reference frame to be used to formulate the mass-extrapolation assumption of the VDM in pion-production processes. (auth)

1465 SIDEWISE DISPERSION RELATIONS AND THE NUCLEON ANOMALOUS MAGNETIC MOMENT. Love, A. (Rutherford High Energy Lab., Chilton, Eng.); Rankin, W. A. Nucl. Phys.; B21: 261-8(1970).

The anomalous magnetic moment of the nucleon is calculated from sidewise dispersion relations retaining contributions from both the threshold region and the resonance region up to 1.76 GeV. (auth)

Weak

1466 (CONF-691202–, Paper 5) J-PLANE PHENOMENA IN WEAK INTERACTIONS. Abarbanel, Henry D. I. (Princeton Univ., N. J. Joseph Henry Labs.). 24p.

From Regge pole conference, University of California, Irvine, December 5–6, 1969.

This is a brief review talk on certain features of Regge theory

as they manifest themselves in lowest order weak and electromagnetic processes. Fixed poles in the J-plane are the primary subject of discussion. After a short reminder of some facts relevant to fixed poles the theoretical and experimental situations are examined. It is concluded that unless there is a compelling theoretical reason for fixed poles, such as current algebra, one may safely proceed without them. Next, two interesting subjects: electromagnetic mass differences and electroproduction structure functions are reviewed in the light of Regge theory. No discussion is given of various detailed Regge pole and/or cut models of photon or weak current induced reactions. (auth)

1467 (COO-264-559) GENERAL LOCAL INTERACTIONS AND TESTS OF V-A THEORY IN NEUTRINO SCATTERING PROCESSES. Cheng, T. P. (Institute for Advanced Study, Princeton, N. J.); Tung, Wu-ki (Institute for Advanced Study, Princeton, N. J., Chicago Univ., Ill. Enrico Fermi Inst. Chicago Univ., Ill. Dept. of Physics). Sep 1970. Contract AT(11-1)-264. 47p. (EFI-70-51). Dep. NTIS.

Neutrino scattering processes are studied in the framework of general local current-current interaction. The scattering amplitudes for such processes are expressed in a simple factorized form in terms of helicity form factors for the current vertex functions. These expressions explicitly display the full kinematic content of the local current-current interaction and are used as the basis for a systematic study of possible ways to test the V−A structure of the weak current in high energy neutrino scattering processes. A direct test in an "inclusive experiment" consists of measuring the outgoing lepton polarization. Alternative tests from angular and spin correlations are possible only in "exclusive experiments." Several examples of this latter type of experiments are given: pure lepton scattering processes, neutrino scattering off spin zero (nuclei) targets, quasi-elastic scattering off polarized nucleon, quasi-elastic hyperon production (decay asymmetry) and (v) single pion production in the N* region. (auth)

1468 (IFVE-STF-70-4) ON SOME PROPERTIES OF THE TOTAL CROSS SECTIONS OF INELASTIC LEPTON-HADRON PROCESSES. Tikhonin, F. F. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1970. 10p. (In Russian). Dep. NTIS (U. S. Sales Only).

The possibilities of investigating the inelastic form factors of lepton-hadron scattering in a simple experiment are considered. (auth)

1469 (UH-511-73-70) NONLEPTONIC DECAY AND THE CURRENT x CURRENT THEORY. Pakvasa, S. (Hawaii Univ., Honolulu); Rosen, S. P. (Purdue Univ., Lafayette, Ind.). Apr 1970. Contract AT(04-3)-511. 37p. (CONF-700424-1). Dep. NTIS.

From Symposium on the Past Decade in Particle Theory, Austin, Tex.

The survey of nonleptonic hadron decay in current × current theory includes decays of particular hadrons, divergence problems, parity-conserving processes, and parity-violating nuclear forces. (J.F.P.)

1470 ANALYSIS OF K_{l2} AND π_{l2} RADIATIVE DECAYS. Smoes, M. (Univ. of Louvain, Belgium). Nucl. Phys.; B20: 237-51(1970).

All leptonic radiative decays of pseudoscalar mesons are studied in a systematic way, using, as phenomenological parameters for the amplitudes, form factors covering all the recent theoretical investigations. This study is made with a view to giving predictions for possibilities and theoretical consequences of the experiments. The rates are shown to be sensitive to the form factors, with the single exception of the process $\pi \to \mu\nu\gamma$. The possibility is explored of measuring transverse lepton polarization in $\pi \to e\nu\gamma$ and $K \to \mu\nu\gamma$ as complementary information on form factors and as a direct test of T-invariance. (auth)

1471 ON THE INDEFINITE METRIC. Mehrotra, R.; Patil, S. H. (Univ. of Delhi). Nucl. Phys.; B20: 252-6(1970).

It is pointed out that: (i) a pseudo-hermitian Hamiltonian has conjugate-energy states if its complex eigenvalues do not belong to the residual spectrum of its adjoint, (ii) particle-antiparticle symmetry puts certain restrictions on the decay channels if there are to be no negative norm, real-energy states, and (iii) exponential time dependence of decays is valid for a pseudo-hermitian Hamiltonian if the initial conditions are chosen with care. (auth)

1472 APPLICATION OF A VECTOR-MESON DOMINANCE MODEL TO $K_{3\pi}$ AND $\eta_{3\pi}$ DECAYS. Hacinliyan, A. S. (Univ. of Chicago). Nuovo Cim.; 70A: 119-35(1 Nov 1970).

The p-wave contributions to $K \to 3\pi$ and $\eta \to 3\pi$ decays are studied by means of a vector-meson dominance model. The p-wave decay rate for $K_S \to 3\pi$ is estimated. Dalitz-plot fits using the energy dependence of matrix elements from the above model, and p-wave decay rate estimates using a generalized spurion concept yield reasonably consistent results for the p-wave contribution to these decays. (auth)

1473 ASTROPHYSICAL EXCLUSION OF PHOTON-NEUTRINO WEAK COUPLING. Stothers, Richard B. (Goddard Inst. for Space Studies, New York). Phys. Rev., D; 2: 1417-18 (15 Oct 1970).

The photon-neutrino coupling theory of weak interactions as presented by Bandyopadhyay is definitely excluded by the astrophysical data for white dwarfs. Furthermore, it is impossible to adjust the photon-neutrino coupling constant so as to reproduce simultaneously the pertinent astrophysical data for white dwarfs and red supergiants. (auth)

1474 DIMENSIONS OF CURRENTS AND CURRENT COMMUTATORS. Beg, M. A. B. (Rockefeller Univ., New York); Bernstein, J.; Gross, David J.; Jackiw, R.; Sirlin, A. Phys. Rev. Lett.; 25: 1231-4(26 Oct 1970).

The scale dimensions of current components and Schwinger terms are studied. Necessary and sufficient conditions for the spatial and temporal components of hadronic currents to have the same dimension are stated and proven. The incompatibility of well-defined c-number Schwinger terms with universal dimensionality of current components is demonstrated. Experimental implications are discussed. (auth)

1475 VENEZIANO MODEL FOR NONLEPTONIC WEAK INTERACTIONS AND QUANTIZATION OF SYMMETRY BREAKING. Ryder, L. H. (Univ. of Canterbury, Kent, Eng.). Lett. Nuovo Cim.; 4: 757-60(17 Oct 1970).

The possibility is considered that nonleptonic weak interactions also have a Veneziano representation. Departure is made from normal convention in not using the spurion technique for writing the four-point function. (J.F.P.)

1476 THREE-PION DECAYS OF K AND η AND CURRENT ALGEBRA. Kellett, B. H. (Univ. of Manchester, Eng.). Nucl. Phys.; B21: 413-26(1970).

The problem of the relation between current algebra and the K and $\eta \to 3\pi$ decays is investigated in terms of the structure of the amplitudes. A detailed analysis of the $\eta \to \pi^+\pi^-\pi^0$ Dalitz plot in terms of a third-order spectrum is given, and the structure found is sufficient to account for all the soft-pion zeros. However, the presence of higher structure is found to reduce the value of extrapolating the phenomenological amplitude off the mass shell for comparison with the current-algebra results. (auth)

1477 LEPTONIC K-DECAYS WITH BROKEN SU(3) ⊗ SU(3) AND SU(3) AND VIOLATION OF μ-e UNIVERSALITY. Chhajlany, S. C.; Pandit, L. K.; Rajasekaran, G. (Tata Inst. of Fundamental Research, Bombay). Nucl. Phys.; B21: 1-14(1970).

A phenomenological treatment of μ-e universality violation in the strangeness-changing decays is proposed to account for the existing discrepancies between the form factors and other decay parameters of the leptonic K-decays determined experimentally and those predicted on the basis of the conventional Cabibbo theory with the first-order broken SU(3) ⊗ SU(3) and SU(3) symmetries. (auth)

1478 P- AND T-NON-INVARIANT TWO-COMPONENT EQUATION FOR THE NEUTRINO. Fushchich, V. I. (Mathematical Inst., Kiev). Nucl. Phys.; B21: 321-30(1970).

The relativistic two-component equation describing the free motion of particles with zero mass and spin ½, which is P- and T-non-invariant but C-invariant, is found. The representation of the Poincaré group for zero mass and discrete spin is constructed. The position operator for such a particle is defined. (auth)

1479 COMPARISON BETWEEN SALIN'S AND ADLER'S MODELS FOR $\nu \to \mu N^*$ REACTIONS. Bijtebier, J. (CERN, Geneva. Univ., Brussels). Nucl. Phys.; B21: 158-72(1970).

A search is made for the origin of the factor-two difference between the cross sections predicted by Salin's and Adler's models for the reaction $\nu p \to \mu^- N^{*++}$. It is found that both models are roughly the same for the vector part, but that the lack of a second axial coupling in Salin's model leads to a violation of PCAC, and to a much larger contribution of the longitudinal axial multipole than in Adler's model. However, the experimental results seeming in favor of Salin's cross sections, a third model is defined, which does not violate PCAC and which can be fitted to experiment through an arbitrary parameter. (auth)

Strong (General)

Refer also to abstracts 1588 and 1642.

1480 (AD-706838) SU(3) × SU(3) AND DILATATION INVARIANCE OF STRONG INTERACTIONS: HOW ARE THEY

REALIZED IN THE SYMMETRY LIMIT? Haberler, P. L. F. (Duke Univ., Durham, N. C. Dept. of Physics). 1970. NTIS.

On general field theoretic grounds it is argued that the bare mass of the proton (baryon-octet) vanishes without implying vanishing physical masses. This suggests that SU(3) × SU(3) and dilatation invariance are realized through the Goldstone–Nambu mechanism in the symmetry limit. (auth)

1481 (CONF-691202) REGGE POLE CONFERENCE, UNIVERSITY OF CALIFORNIA, IRVINE, DECEMBER 5–6, 1969. (California Univ., Irvine). 287p. Dep. NTIS.

The conference included eight papers six of which are included in the proceedings. One paper was abstracted previously in NSA. For an abstract of this paper see abstract number 24: 18293. Separate abstracts were prepared for five papers. (J.F.P.)

For abstracts of individual papers see: 1466 and 1482–1485.

1482 (CONF-691202–, Paper 1) REGGE ANALYSES OF HIGH-ENERGY SCATTERING DATA. Barger, V. (Wisconsin Univ., Madison. Dept. of Physics). 45p.

From Regge pole conference, University of California, Irvine, December 5–6, 1969.

Examples of effective Regge pole and exploratory pole plus cut models are discussed. Meson pole phenomenology of π N forward elastic and charge-exchange data, interpretations of recent Serpukhov total cross section data, and the status of fermion exchange models for backward scattering are considered. (J.F.P.)

1483 (CONF-691202–, Paper 2) PHENOMENOLOGICAL ANALYSES USING POLES AND CUTS. Ross, Marc H. (Michigan Univ., Ann Arbor). 32p.

From Regge pole conference, University of California, Irvine, December 5–6, 1969.

Regge cut models are described, and fits to charged and neutral photoproduction, nucleon–nucleon charge exchange, backward pion scattering, and backward photoproduction reactions are shown. (J.F.P.)

1484 (CONF-691202–, Paper 3) VENEZIANO FORMULA. Lovelace, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 48p.

From Regge pole conference, University of California, Irvine, December 5–6, 1969.

Recent progress in Veneziano theory is reviewed. Topics discussed include the harmonic oscillator formalism, factorization properties, Olesen's cure of the loop divergence, precedents for dual models in nuclear physics, phenomenology with 5-point functions, experimental evidence against planar duality diagrams. "Classical" Veneziano theory, such as the theory of meson–meson scattering, is treated more briefly since it has been so much reviewed already. (auth)

1485 (CONF-691202–, Paper 4) PHENOMENOLOGY OF MULTIPARTICLE PRODUCTION. Berger, Edmond L. (Argonne National Lab., Ill.). 76p.

From Regge pole conference, University of California, Irvine, December 5–6, 1969.

Certain aspects of multiparticle data and phenomenology are summarized. General multipheripheralism, the data, explanations for striking features, multi-Regge and multipheripheral theories, two-to-three body reactions, threshold enhancements, and multiparticle final states are treated. (J.F.P.)

1486 (ITEF–763) ON QUARKS WITH COMPLEX SPIN. Roginskii, V. I.; Shapiro, I. S. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1969. 20p. (In Russian). Dep. NTIS (U. S. Sales Only).

Previously the foundations of quantum kinematics of a system of two "particles" with complex spins, differing by an integer or a half odd integer number, were formulated. It is shown that it is possible to construct dynamics of such a system: to introduce the Hilbert space of states and the Hamiltonian, to take account of identity of "particles". A compound model in which elementary particles are thought as consisting of two unobservable complex spin "quarks" is discussed (the case of spin-$\frac{1}{2}$ is considered). It is shown that in this model the mass spectrum and properties of particles (for instance, multipole momenta and magnetic moments) can prove essentially different than in the conventional compound model (when quark's spin is integer or half odd integer). (auth)

1487 POLARIZATION PREDICTIONS AND THE QUARK AND PERIPHERAL MODELS. Lipkin, Harry J. (Weizmann Inst. of Science, Rehovot, Israel. Argonne National Lab., Ill.). Contract F-61052-68-C-0070. Nucl. Phys.; B20: 652-62(1970).

Inconsistencies and ambiguities in the interpretation of quark-model predictions for decay correlations in resonance production are discussed. A proper relativistic treatment shows which predictions from the non-relativistic model can be expected to hold at relativistic energies where experimental tests are made. The existence of reasonable peripheral models which lead to the same predictions is pointed out, thus indicating that success of the predictions is not necessarily evidence supporting the quark model. (auth)

1488 ARGAND LOOPS IN THE LEE MODEL. Simon, Joel M. (Rutgers–The State Univ., New Brunswick, N. J.). Nucl. Phys.; B20: 257-68(1970).

The elastic amplitudes in the scalar Lee model are studied with the help of Argand diagrams in order to determine the relative importance of inelastic thresholds and the Peierls (P) singularity. An input Nθ resonance, constructed separately by either the choice of the cut-off function or by a CDD pole, leads to non-resonant loops in the Argand diagram of the elastic Vθ amplitude which are associated with the N*θ threshold. The P-mechanism works neither in a non-CDD case because the Nθ resonance is necessarily too large, nor in the CDD case because of an explicit cancellation. The low-energy part of the Vθ spectrum, in the absence of input resonances, is characterized by simultaneous Vθ bound-states and anti-resonances. The absence of low-energy Vθ resonances, in the non-CDD case, is connected to the cusp in the elastic Nθ denominator at the Nθ threshold. (auth)

1489 PHENOMENOLOGY OF DOUBLE REGGE POLES. Bialkowski, G. (Univ., Turin). Acta Phys. Pol.; B1: 109-21(Apr-Jun 1970).

The problem of the experimental consequences of the assumption of the existence of double Regge trajectories is discussed from the point of view of the resonances region as well as the high energy region. Some arguments in favor of such a hypothesis are presented. The finite-energy sum rules and Veneziano representation for the double poles are written down and briefly discussed. (auth)

1490 HIGH-ENERGY BEHAVIOR OF TOTAL CROSS SECTIONS. Yodzis, P.; Ingraham, R. L. (New Mexico State Univ., Las Cruces). Phys. Rev., D; 2: 1493-8(15 Oct 1970).

A method is presented for obtaining an asymptotic series, for large values of the energy, of a four-dimensional Fourier transform, using only one analyticity assumption. It is shown that this method implies (1) asymptotic constancy of hadron total cross sections, as an "upper bound," and (2) the Pomeranchuk theorem. A consistency check, which lends some plausibility to our assumptions, is made. The calculations are done within the context of frame-dependent cutoff quantum field theory. (auth)

1491 LORENTZ-INVARIANT ALGEBRAIZATION OF PION–HADRON VERTEX FUNCTIONS. Katz, J.; Noga, M. (Purdue Univ., Lafayette, Ind.). Phys. Rev., D; 2: 1657-62(15 Oct 1970).

Making use of rather general dynamical assumptions, it is proven that the problem of determining relativistic pion transition amplitudes may be completely reduced to the study of unitary representations of the noncompact dynamical group SO(3,1) ⊗ SO(4,3), since matrix elements of physical observables are shown to form a closed algebra which is identical with the Lie algebra of this group. These assumptions are Lorentz and isospin invariance of strong interactions, the Lehmann-Symanzik-Zimmermann reduction technique, an effective-interaction Lagrangian or partial conservation of axial-vector current, the usual equal-time commutator algebra between axial charges, and the absence of exotic states. The connection with the dynamical group approach previously proposed by Barut is discussed. (auth)

1492 DYNAMICAL FORMULATION FOR BOOTSTRAP SYSTEMS. Trivedi, U. (California Inst. of Tech., Pasadena). Contract AT(11-1)-68. Phys. Rev., D; 2: 1519-34(15 Oct 1970).

The view that perhaps bootstrap systems are in some sense different from the usual composite systems such as the hydrogen atom, positronium, nuclei, etc. A set of assumptions is presented to define and give analytical content to the notion of a bootstrap system. As one of the assumptions, a dynamical equation governing the bootstrap state function is given. The dynamical equation is the relativistic analog of the Lippmann-Schwinger equation. In the concluding section the classification scheme for hadrons, and Ansätze for parametrizing the S matrix as suggested by the dynamical equation are given. The classification scheme is successful in ordering the hadron spectrum to some extent, but requires further development to make it more powerful. The various Ansätze for the S-matrix which emerge have been introduced in the literature before and used with success. The introduction of these Ansätze had varying motivations and in some cases were purely ad hoc. In this work, they emerge naturally as suitable approximations, in the relevant energy regions, of a common dynamical equation. (auth)

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1493 CONJECTURED SET OF EXACT BOOTSTRAP EQUATIONS. Chu, Shu-yuan (Univ. of California, Riverside); Kaus, P.; Zachariasen, F. Contract AT(11-1)-68. Phys. Rev., D; 2: 1535-41(15 Oct 1970).

A set of exact bootstrap equations is conjectured, consisting of two coupled homogeneous equations for the vertex function and the propagator from which any n-legged amplitude can be constructed. One equation is analogous to the vanishing of vertex renormalization constants ($Z = 0$); the second equation expresses "duality." All graphs can be reduced to the simple tree diagram. Amplitudes, if solutions exist, will be crossing symmetric and will have at least all the necessary singularities making unitarity plausible but not proved. (auth)

1494 QUARK CHARGE FLUCTUATION: A POSSIBLE BINDING MECHANISM FOR QUARKS IN HADRONS. Rosen, G. (Drexel Univ., Philadelphia). Lett. Nuovo Cim.; 4: 721-3(17 Oct 1970).

It is pointed out that if the superselection rule does not apply to fractionally charged quark states and the expectation value $\langle q|Q^2|q\rangle$ is of the order $\hbar c$ (rather than a fraction of e^2), then unconventionally strong Coulomb forces are likely to be responsible for quark binding in hadrons. It is shown that a charge-fluctuation Coulombic binding mechanism can indeed give rise to the low-lying bound states observed for the $q\bar{q}$ and qqq hadron systems. (J.F.P.)

1495 LOW SUBENERGIES, CROSSED RUNGS, AND DUALITY IN THE MULTIPERIPHERAL BOOTSTRAP. Halliday, I. G. (Imperial Coll. of Science and Tech., London). Nucl. Phys.; B21: 445-64(1970).

A method is given for including the effects of crossed rungs and low subenergies in the multiperipheral bootstrap equations. The two problems turn out to be closely related. Due to the introduction of low-energy parameters the bootstrap equations are no longer of closed form. The duality approximation which would allow the removal of these extraneous factors is discussed. (auth)

Strong (Baryon No. = 0)

Refer also to abstract 1639.

1496 (AD-705549) GENERATING FUNCTIONALS, WARD IDENTITIES, AND SCALAR MESONS. Parisi, G.; Testa, M. (Rome Univ. (Italy). Istituto di Fisica). 27 Sep 1969. Contract F61052-67-C-0084. 16p. (NI-242; AFOSR-70-1234-TR). NTIS.

A general and concise treatment of Ward identities in current algebra with broken symmetry is presented. An application is also presented to the mass spectrum and leptonic decay constants of the scalar and pseudoscalar mesons. (auth)

1497 (JINR-P1-5340) SEARCH FOR THE DOUBLET STRUCTURE OF MESON RESONANCES USING THE FOURIER ALGORITHM. Dubovik, V. M.; Markovskii, B. L.; Soroko, L. M.; Strizh, T. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1970. 28p. (In Russian). Dep. NTIS (U. S. Sales Only).

The experimental data on the meson resonances A_2, $K^*(1420)$ and ρ_0 are analyzed anew using the Fourier algorithm. In the information region of the energy frequencies the minima are absent which can be interpreted as the proof of the doublet structure of $K^*(1420)$ and ρ_0-resonances. The location of the boundary between the information and informationless regions in the energy-frequency scale determined the real resolution of missing mass spectrometer. (auth)

1498 (UH-511-79-70) COMMENTS ON THE COMPATIBILITY OF THE VENEZIANO MODEL WITH CURRENT ALGEBRA AND CHIRAL SYMMETRY. Dobson, P. N. Jr.; Simmons, W. A. (Hawaii Univ., Honolulu). Sep 1970. Contract AT(04-3)-511. 7p. Dep. NTIS.

It is shown that the Veneziano model with off-shell correction factor is compatible with the (3,3*) + (3*,3) symmetry-breaking scheme. The $K\pi$ scattering is discussed. (J.F.P.)

1499 EXORCIZED, FACTORIZING DUAL AMPLITUDE FOR SIX CHARGED PIONS. Dorren, J. D.; Rittenberg, V.; Rubinstein, H. R. (Weizmann Inst. of Science, Rehovoth, Israel). Contract F-61052-68-C-0070. Nucl. Phys.; B20: 663-73(1970).

The study of amplitudes previously proposed that possess the πA_1 three-body trajectory and the ρf trajectory in the two-body channels is continued. The $\pi^+\rho^0 \to \pi^+\rho^0$ amplitude is deduced. This amplitude has no parity doubling on any of the leading trajectories. By using the positivity and the Adler conditions it is shown that the possible forms of the amplitude are severely restricted. Degeneracy of the levels along the leading πA_1 trajectory with the exception of spin 0 and spin 1 is predicted. The positivity conditions were only imposed on the parent trajectory, so that the overall consistency of the $\pi\rho$ amplitude has not been fully checked. If the A_1 is required to be a single level, the amplitude has no free parameters. The existence of an amplitude which obeys the bootstrap condition, which has positivity and no parity doubling along the parent trajectory, and which satisfies the Adler condition is regarded as a remarkable consistency test for the N-point function. (auth)

1500 NORMALISATION OF THE $\bar{p}n \to 3\pi$ AMPLITUDE BY MASS EXTRAPOLATION. Rubinstein, H. R. (Weizmann Inst. of Science, Rehovot, Israel); Chaichian, M.; Squires, E. J. Nucl. Phys.; B20: 283-6(1970).

The $\bar{p}n \to 3\pi$ rate was evaluated at rest from the πNN and $\rho\pi\pi$ coupling constants. The model is consistent with the experimental rate. (auth)

1501 VENEZIANO MODELS FOR $\pi\pi \to \eta$ + BOSON OF ANY SPIN. Argyres, Ernestos N. (State University Coll., Plattsburgh, N. Y.); Contogouris, A. P.; Lam, C. S. Nucl. Phys.; B20: 269-82(1970).

The process $\pi\pi \to \eta X$, where X has any spin and parity, is considered in the Veneziano representation. By means of simple, satellitefree models and the Adler condition a number of particle masses and trajectory intercepts are determined. The special case $X = D^0$ (1270), studied in more detail, leads to mass and width estimates of certain newly discovered bosons and to a calculation of the Dalitz plot for the decay $D^0 \to \pi^+\pi^-\eta$ in accord with the data. (auth)

1502 ALTERNATIVE TO EXCHANGE DEGENERACY: THE TOTAL ABSORPTION LIMIT. Peschanski, R. (CEN de Saclay, Gif-sur-Yvette, France). Nuovo Cim.; 70A: 75-89(1 Nov 1970).

Whereas global duality implies exchange degeneracy in the framework of a "pure" Regge model, it is shown that, in Reggeized absorption models, global duality leads to another possible description of the same physics: a model without exchange degenerate Regge poles, whose main feature is a condition of total absorption on the Pomeron partial waves at high energy. This alternative to exchange degeneracy is shown to have been used implicitly in existing fits (πN, NN, KN). Then pion–pion scattering using factorization is studied. A phenomenological amplitude compatible with global duality, exoticism and factorization of Regge poles is built. Semi-local duality in the s-waves is then shown to imply directly the total-absorption limit. No evidence was found at present against this new approach to duality, where the Pomeron exchange, and thus inelastic unitarity plays an important and unusual part. (auth)

1503 REALIZATIONS OF CHIRAL TRANSFORMATIONS: EXPLICIT FORMS. Charap, John M. (McGill Univ., Montreal). Can. J. Phys.; 48: 2272-82(1 Oct 1970).

The parallel approaches to the general problem of giving nonlinear realizations of chiral $SU(n) \otimes SU(n)$ appropriate to phenomenological field theories as derived by Callan, Coleman, Wess, and Zumino on the one hand, and by Barnes and Isham on the other, are reviewed and compared. Explicit expressions are given for the nonlinear functions of the pseudoscalar meson field variables which arise in these methods. (auth) (Canada)

1504 CURRENT-FIELD IDENTITIES. Genz, H. (Univ. of California, Berkeley); Katz, J. Nuovo Cim.; 70A: 1-11(1 Nov 1970).

The spectral representation for the vacuum expectation value of the axial-vector-current commutator is used to discuss the current-field identities given by $g_A a_\mu^\alpha(x) = f_\pi \partial_\mu \varphi^\alpha(x) + A_\mu^\alpha(x)$. Here $a_\mu^\alpha(x)$ denotes the axial-vector-meson field, g_A is a properly chosen normalization constant, and the pion field $\varphi^\alpha(x)$ is defined by the relation $\partial^\mu A_\mu^\alpha(x) \equiv \phi^\alpha(x) = f_\pi m_\pi^2 \varphi^\alpha(x)$, where $A_\mu^\alpha(x)$ denotes the axial vector current. The consequences for canonical realizations of current-field identities and PCAC are given. It is also found that the vacuum expectation value of the σ-term is nonvanishing unless the current is conserved and that a nonconserved charge cannot annihilate the vacuum (as stated by Coleman's theorem). (auth)

1505 PREDICTION ON THE SLOPE PARAMETER OF ELASTIC $p\bar{p}$ DIFFRACTION SCATTERING IN THE MOMENTUM RANGE (12 TO 70) GeV/c. Chow, G. Y. (Saginaw Valley Coll., University Center, Mich.). Nuovo Cim.; 70A: 23-30(1 Nov 1970).

The absorptive correction to quasi-elastic scattering is included in the model proposed previously for elastic diffraction scattering of hadrons at high energies. Prediction on the slope parameter of elastic $p\bar{p}$ diffraction scattering for $0.008 < |t| < 0.12$ $(GeV/c)^2$ in the momentum range 12 to 70 GeV/c is given. (auth)

1506 CLOSED-LOOP CALCULATIONS USING A CHIRAL-INVARIANT LAGRANGIAN. Charap, John M. (Univ. of California, Santa Barbara). Phys. Rev., D; 2: 1554-61(15 Oct 1970).

Using Feynman rules derived from the chiral-invariant Lagrangian for pions, explicit evaluation is made of all contributions to all Feynman amplitudes in the limit of zero external

4-momenta, through order f_π^6. These calculations are formal in that they involve divergent integrals. For all except the tree-graph diagrams, the results depend explicitly upon the pion "gauge," or Weinberg's function $f(\pi^2)$. However, it is shown that through order f_π^6 there is a unique choice of gauge for which, notwithstanding the divergences, the amplitudes vanish in the soft-pion limit in accord with the soft-pion theorems. Further application of this special gauge for the removal of divergences is conjectured. (auth)

1507 FEYNMAN-DIAGRAM MODELS OF BOSON DAUGHTER TRAJECTORIES. Steele, David (Univ. of Illinois, Urbana). Phys. Rev., D; 2: 1610-20(15 Oct 1970).

Some Feynman-diagram models of Regge poles are used to study daughter trajectories of bosons in scalar-meson–scalar-meson scattering. Both the simple model with bare propagators and a generalized model that includes propagator self-energy insertions are considered. It is found that, in the simple model, the second daughter is a fixed (as a function of the squared momentum transfer t) double pole in complex J plane. When self-energy corrections to the propagator are included, the fixed double pole breaks up into a moving daughter trajectory and a moving companion trajectory. It is found that away from t = 0, the daughter and companion trajectories get mixed up in a complicated and model-dependent manner. (auth)

1508 CURRENT ALGEBRA BEYOND THE TREE APPROXIMATION. Schnitzer, Howard J. (Rockefeller Univ., New York). Contract AT(30-1)-3178. Phys. Rev., D; 2: 1621-29(15 Oct 1970).

A method is presented for constructing current-algebra amplitudes which satisfy (1) threshold theorems, (2) crossing symmetry, (3) approximate unitarity, and (4) cut-plane analyticity; and reduce to the usual tree approximation in the narrow-resonance limit. Pion-pion scattering is considered in detail to illustrate the method. A derivation of the Kawarabayashi–Suzuki–Riazuddin–Fayyazuddin relation is provided which makes no reference to vector-meson dominance. (auth)

1509 GENERAL CHIRAL ALGEBRA AND $\pi\pi$ SCATTERING LENGTHS. Bars, Itzhak (Yale Univ., New Haven). Contract AT(30-1)-1726. Phys. Rev., D; 2: 1630-9(15 Oct 1970).

Weinberg's and Khuri's current-algebra calculations for the low-energy $\pi\pi$ amplitude are generalized by allowing an isospin I = 2 component in the σ commutator (as opposed to a pure I = 0 component given in the σ model used by both authors). A consistency condition for the $\pi\pi$ amplitude is derived when one of the pions has zero four-momentum $q_1 = 0$, and the others restricted so that $0 < q_2^2, q_3^2, q_4^2 < \mu^2$. Using this consistency condition, the power-series expansion of the amplitude in the variables s, t, and u is calculated up to fourth order in the momenta. It is found that the coefficients of the fourth-order terms are much smaller than the second-order ones in all models. The scattering lengths are calculated in several models without resorting to an expansion of the σ commutator into a series of the pion field. It is found in each model that the current-algebra calculation of the scattering lengths agrees with the effective Lagrangian calculation in the tree-diagram approximation. The reason for the agreement can be traced to the negligible contributions of the fourth- and higher-order terms in the pion field when the σ commutator is expanded in a series. (auth)

1510 PHYSICAL-REGION CONSTRAINTS ON LOW-ENERGY PARTIAL-WAVE AMPLITUDES. II. $\pi\pi$ SCATTERING. Roskies, Ralph (Yale Univ., New Haven). Contract AT(30-1)-2726. Phys. Rev., D; 2: 1649-56(15 Oct 1970).

Physical-region constraints on the low partial waves of $\pi\pi$ scattering are derived on the basis of analyticity, crossing, and positivity of the absorptive parts. These constraints are sensitive only to the low-energy behavior of the partial-wave amplitudes. The necessity for subtractions in the dispersion relations implies that no results can be obtained for s and p waves. (auth)

1511 ANALYTIC HARD-PION METHODS: THE $A_1\,\rho\pi$ SYSTEM. Brehm, J. J.; Golowich, E. (Univ. of Massachusetts, Amherst). Phys. Rev., D; 2: 1668-80(15 Oct 1970).

Current algebra and analyticity are used to study vertex functions occurring in the $A_1\rho\pi$ system. Employing the conserved vector current and partially conserved axial-vector current relations, and the SU(2) × SU(2) algebra of currents, Ward identities are generated which relate two- and three-point functions of vector and axial-vector currents. Extracting the pion poles from these vertex functions and exposing their isospin content, form factors are defined whose analytic properties may readily be studied and, in particular, a relation involving the pion form factor is deduced from the Ward identities. With suitable low-energy approximations which maintain the correct cut structure, this relation is used to calculate an effective-range formula for the pion form factor, and consequently from unitarity, the p-wave $\pi\pi$ phase shift. The results are generally in agreement with experiment. Using A_1 dominance, analytic effective-range formulas are obtained for the form factors appearing in the vector-current matrix element of π, A_1 mesons. From these form factors, measurable in the reaction $e^+e^- \to \pi A_1$, the $A_1 \to \rho\pi$ width and the A_1-ρ spin correlation are calculated. Finally, the methods to encompass are extended both $\pi\pi$ and πA_1 cut contributions, and a set of coupled integral equations are derived which are solved approximately for the $\pi\pi$ and πA_1 form factors. A general observation on the complementary roles played by current algebra and by unitarity is given. (auth)

1512 PION-PION DYNAMICS IN THE σ MODEL. Basdevant, J. L. (CEN de Saclay, Gif-sur-Yvette, France. Laboratoire de Physique Theorique et Hautes Energies, Orsay, France); Lee, B. W. Contract AT(30-1)-3668B. Phys. Rev., D; 2: 1680-1701(15 Oct 1970).

An unambiguous way of constructing amplitudes which satisfy both unitarity and the current-algebra constraints is proposed. This consists in working out higher-order corrections on a Lagrangian which produces the correct soft-pion limit in the tree approximation. $\pi\pi$ scattering is considered in the σ model, and the perturbation series is computed up to second order. The renormalization procedure preserves the partially conserved axial-vector current condition and the current-algebra constraints at each order. In order to sum the strong-coupling perturbation series, the Padé-approximation technique is used. Thereby, the partial-wave amplitudes satisfy unitarity. The ρ and f_0 resonances are generated, although they were not present in the Lagrangian. Our unitary amplitudes satisfy crossing symmetry to a very good accuracy, showing the consistency of the results. The results are in agreement with the "up-down" solution of the I = 0, s-wave $\pi\pi$ phase shift, with a very broad σ resonance; the I = 2 s-wave phase shift is repulsive, and agrees very well with experiment. (auth)

1513 UNITARITY CONSTRAINT ON A REGGE TRAJECTORY IN A MODEL AMPLITUDE. Thiebaux, M. L. (Univ. of Massachusetts, Amherst). Phys. Rev., D; 2: 1711-15(15 Oct 1970).

A representation is constructed for the elastic scattering of neutral scalar bosons with crossing symmetry, direct-channel poles, polynomial residues, and Regge behavior based on an arbitrary Regge trajectory. It is shown, within the context of a specific model, how the amplitude can approximately satisfy elastic unitarity. A purely linear trajectory is inconsistent with the unitarity constraint unless the amplitude is zero, while the addition of a complex threshold term of definite strength enables elastic unitarity to be numerically approximated. (auth)

1514 UNIFIED FIELD THEORY OF ELEMENTARY PARTICLES. III. MESON MULTIPLET STRUCTURE. van der Merwe, P. du T. (Atomic Energy Board, Pretoria). Nuovo Cim.; 70A: 70-4(1 Nov 1970).

Effects of electrodynamics on mesons in the unified theory of elementary particles are investigated. The most notable results are an enhancement in the coupling constant of the excited η-meson to fermions and effects on the boson spectrum as exemplified by the meson multiplet structure. (auth)

1515 MINIMAL FACTORIZED VENEZIANO AMPLITUDES FOR THE REACTIONS $A_1\pi \to A_1\pi$, $A_1\pi \to \pi\pi$, $\pi\pi \to \pi\pi$. Lasley, Eric; Carruthers, P. (California Inst. of Tech., Pasadena). Contract AT(11-1)-68. Phys. Rev., D; 2: 1724-32(15 Oct 1970).

Explicit minimal amplitudes are constructed for the reactions $A_1\pi \to A_1\pi$, $A_1\pi \to \pi\pi$, and $\pi\pi \to \pi\pi$. All amplitudes have correct Regge asymptotic behavior corresponding to the (degenerate) ρ-f trajectory dominant in all channels. Signature is systematically enforced to leading order so that the poles on the leading trajectory have the correct spin and parity. The parity-conserving helicity amplitudes for $A_1\pi \to A_1\pi$ factorize, and multichannel factorization for the three coupled amplitudes is enforced for the leading trajectory. Multichannel factorization requires the extension of the $A_1\pi \to \pi\pi$ amplitude, but the parameters in the new amplitude are all determined, except for two which can be identified with the (independent $A_1\rho\pi$ couplings G_S and G_D. Two acceptable $A_1\pi \to A_1\pi$ amplitudes are found, each involving two arbitrary constants in addition to $f_\rho = f_{\rho\pi\pi}$, G_S, G_D, and the three $A_1A_1\rho$ couplings g_1, g_2, and g_3. These couplings are not constrained by the model except for one relation connecting G_D and g_3. These results are compared with the hard-pion analysis by Schnitzer and Weinberg. (auth)

1516 LOW ENERGY $\pi-\pi$ RESONANCES IN THE VENEZIANO MODEL. Antoniou, N. G.; Papaioannou, G. M. (Democritus Nuclear Research Center, Athens). Z. Phys.; 239: 16-24(1970).

An attempt is made to impose elastic unitarity on the forward $\pi-\pi$ scattering using the Veneziano amplitude together with a crossing symmetric subtraction term as an input. The N/D method is used and the ρ, ϵ mesons are interpreted as CDD

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poles. The self-consistency requirement led to the evaluation of the low-energy parameters and the S and P-wave phase shifts. The values of the scattering lengths obtained are $a_0^0 = 0.084\ m_\pi^{-1}$, $a_2^0 = -0.024\ m_\pi^{-1}$, $a_1^1 = 0.047\ m_\pi^{-3}$. (auth)

1517 PERTURBATION OF RELATIVISTIC BOOTSTRAPS. Wallace, M. R. (Univ. of Sussex, Brighton, Eng.). J. Phys., A (London); 3: 505-19(Sep 1970).

The investigation of two problems is reported: (i) the possibility of bootstrapping bound-state scalar and vector mesons from scalar constituents, in an off-shell model, utilizing the direct interaction theory of Bakamjian and Thomas, and then (ii) the effect of applying a linear perturbation procedure to the masses and coupling constants of these solutions. In (i), the Lippmann–Schwinger formalism and an approximate form of crossing symmetry are used to obtain expressions for the bound-state residues, giving solution to both the scalar and vector cases with properties in excellent agreement with Bethe–Salpeter and N/D dispersion results of others. In (ii) is calculated the relative contributions of the "driving-term" and "feedback" mechanisms. In the S-wave case it is found that the attractive perturbation increases the binding of the bound state, but in the P-wave case, treated with a cut-off, a "sign-reversal" of the mass-shift arising from the "feedback" is obtained. (auth) (UK)

1518 ABSORPTIVE CORRECTIONS TO THE VENEZIANO MODEL. Roberts, R. G. (Univ. of California, San Diego, La Jolla). Nucl. Phys.; B21: 528-40(1970).

The problem of unitarizing the Veneziano model is considered in a way which takes into account absorptive effects from other channels. Lovelace's K-matrix unitarizing procedure is extended so that the Pomeranchuk appears naturally as the expression for the shadow of inelastic scattering. The predictions of the model for $\pi\pi$, $\bar{K}N$ and KN elastic scattering at low energies are compared with the experimental data. Finally inelastic scattering is considered and an absorptive Veneziano model for the process $\bar{N}N \to \bar{K}K$ is discussed. (auth)

1519 VVP INTERACTIONS IN A BROKEN SU(3) LAGRANGIAN GAUGE MODEL. Burnel, A. (Univ., Liege). Nucl. Phys.; B21: 568-76(1970).

The VVP interactions are studied in the framework of a broken SU(3) current-mixing Lagrangian gauge model. The resulting formulas are independent of any particular symmetry breaking mechanism provided field algebra is satisfied and the numerical values are discussed for various mixing angles. Agreement with experiment is, for some models, satisfactory enough to avoid the introduction of additional sophisticated symmetry breaking terms. (auth)

1520 POSSIBLE QUASINUCLEAR NATURE OF HEAVY MESON RESONANCES. Dalkarov, O. D.; Mandelzweig, V. B.; Shapiro, I. S. (Inst. of Theoretical and Experimental Physics, Moscow). Nucl. Phys.; B21: 88-92(1970).

It is shown that a nucleon–antinucleon potential interaction gives rise to a number of nuclear-like non-relativistic bound states appearing as heavy mesonic resonances (with masses close to the double-nucleon mass). (auth)

1521 ABSORPTIVE EFFECTS IN THE TWO-PION DECAY OF THE OMEGA MESON AND THE THREE-PION DECAY OF THE RHO MESON. Allcock, G. R. (Univ. of Liverpool). Nucl. Phys.; B21: 269-87(1970).

It is shown that the amplitude for the decay of an ω-meson into two pions at an invariant total mass equal to that of the ρ^0 meson can be described as though due entirely to the mediation of a virtual ρ^0, coupled to the ω by an effective electromagnetic interaction Lagrangian $\lambda(\omega \cdot Q^0 - \omega^0 \rho^{00})$. The imaginary part of λ is fixed in magnitude by various considerations based mainly on unitarity, hermiticity, the substitution law, and certain SU(3) signs. The sign of Im λ is linked through the same considerations to the signs of the photon–ω and photon–ρ^0 couplings, and is positive in any convention which attributes equal signs to the two latter couplings. It is estimated that the magnitude of Im λ lies in the range 220 MeV^2 to 250 MeV^2. The theoretical value of Re λ always has the same sign as Im λ. General formulas for the mass-dependence of the decay amplitude are given, and a specific model is put forward. A simplified general approach, appropriate to the analysis of $\rho^0 - \omega$ interference in the $\pi\pi$ sub-channel under conditions where the ρ^0 amplitude cannot be measured or calculated with precision, is formulated and the three-pion sub-channel is also treated. The special model theory advocated gives as a by-product the mass formula $M_{00} = M_\rho + (2\pi)^{-1}\Gamma_\rho$, where M_{00} is the ρ-mass in the absence of strong coupling to the $\pi\pi$ channel. This formula suggests that it may be possible to give a simple quantitative theory of the $\omega - \rho$ strong-interaction mass difference. (auth)

1522 VENEZIANO AMPLITUDE AND CHIRAL SYMMETRY BREAKING. Ellis, John (Cambridge Univ.). Nucl. Phys.; B21: 125-34(1970).

The possibility is investigated that representations of pseudoscalar-meson scattering amplitudes with two particles off-mass-shell consistent with current algebra and PCAC can be obtained by multiplying Veneziano amplitudes by some function of the off-mass-shell momenta. Consistency between pion and kaon low-energy theorems at the (πK) scattering amplitude requires that the parameter c which describes the relative strength of SU(3) and chiral symmetry violation in the $(3,3^*) + (3^*,3)$ model of SU(3) × SU(3) breaking has the value −1.17. This value of c would imply unacceptably large violations of pion low-energy theorems at matrix elements of scalar densities. (auth)

1523 DUALITY AMONG LEADING TRAJECTORIES: EXAMPLE OF PION–PION SCATTERING. Johnson, Robert C. (Durham Univ., Eng.). Nucl. Phys.; B21: 117-24(1970).

Relaxing the requirements of strict local duality and exact crossing symmetry the predictions of the lowest-moment finite-energy sum rules for $\pi\pi$ scattering are examined, taking into account only the leading normal Regge trajectories (ρ,f^0) and their lower recurrences. Crossed-channel trajectories computed from narrow-resonance saturated sum rules are shown to be linear at large t with a universal slope linked to the choice of Regge-resonance matching energy, and numerical calculations bear this out. It is found that for a range of t the constraints on the ρ and f^0 Regge poles implied by duality plus the absence of exotic states can be quite well satisfied without introducing towers of daughter resonances. This leads to the suggestion that perhaps duality predictions about lower-lying trajectories should not be taken too seriously. (auth)

1524 CHIRAL DYNAMICS OF A_1–ρ–π SYSTEM. Zubnik, B. M.; Ogievetskii, V. I. (Joint Inst. for Nuclear Research, Dubna, USSR). JETP Lett. (USSR) (Engl. Transl.); 12: 135-8(20 Aug 1970).

An effective interaction Lagrangian of the A_1–ρ–π mesons is constructed containing not more than two derivatives in each term and giving the minimum degree of the four-momenta in all the vertices. The limitation of the dependence of the contact vertices on the four-momenta leads to reasonable physical consequences. (J.F.P.)

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Refer also to abstract 1424.

1525 (COO–1428-237) DOUBLE-REGGE POLE ANALYSIS OF $\pi^+p \to \pi^+f^0p$ AT 13.1 GeV/c. Gaidos, J. A.; Ezell, C. R.; Lamsa, J. W.; Willmann, R. B. (Purdue Univ., Lafayette, Ind. Dept. of Physics). [1970] Contract AT(11-1)-1428. 24p. Dep. NTIS.

A double-Regge model consistent with duality is applied to the reaction $\pi^+p \to \pi^+f^0p$ at 13.1 GeV/c. The diffractively produced πf^0 system is well described by two amplitudes involving Pomeranchuk/A_2 and Pomeranchuk/f^0 exchanges. (auth)

1526 (ITF-70-39) THE PROCESS $\pi N \to \omega N$ AT HIGH ENERGIES. Kobylinskii, N. A. (Akademiya Nauk Ukrainskoi SSR, Kiev. Institut Teoreticheskoi Fiziki). 1970. 9p. (In Russian). Dep. NTIS (U. S. Sales Only).

It is shown that the experimental data for the cross section and density matrix of the process $\pi N \to \omega N$ at 4.19 GeV require for their explanation to take into account not less than four singularities with definite quantum numbers: two with natural and two with unnatural parity. A consideration is made of the model (ρ + P + B) describing a number of features of the present experimental data. A violation of the vector dominance model predictions is also noted. (auth)

1527 (JINR–E2-5226) EXCHANGE QUASIPOTENTIAL FOR THE HIGH-ENERGY $\pi^\pm$p-SCATTERING AND THE PROBLEM OF LINEARITY OF THE REGGE TRAJECTORIES. Matveev, V. A.; Slepchenko, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1970. 21p. Dep. NTIS (U. S. Sales Only).

A general integral representation for the exchange quasipotential is used. The Veneziano-like representation for the problem of the difference of the total cross sections for $\pi^\pm$p-scattering is considered. (auth)

1528 (JINR–P2-5302) ON p-WAVES OF THE πN-SCATTERING IN THE MODEL WITH SHORT-RANGE REPULSION, Zhuravlev, V. I.; Mescheryakov, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1970. 20p. (In Russian). Dep. NTIS (U. S. Sales Only).

A solvable model for p-waves of the πN-scattering from the

condition $f_{13} = f_{31} = 0$ is obtained from previous equations. The model has an interesting peculiarity: the condition of the crossing symmetry on the matrix elements of S-matrix is inhomogeneous. The solutions of the model contradict the experimental data. The reasons for this contradiction are discussed. (auth)

1529 (NYO-2262-TA-224) SUMMING SOFT PSEUDOSCALAR PIONS. Fried, H. M. (Brown Univ., Providence, R. I. Dept. of Physics). [1970]. 19p. Dep. NTIS.

Momentum transfer dependent damping of the nucleon form factors due to the virtual exchange of soft, nonchiral, pseudoscalar pion pairs is estimated. When chirality is enforced, by embedding the calculation in the nonlinear σ model, these soft effects are shown to cancel to all orders in the strong coupling. By themselves, the contributions described here do not easily fit the experimental data. (auth)

1530 (ORNL-4606) NUCLEON-MESON TRANSPORT CODE NMTC. Coleman, W. A.; Armstrong, T. W. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 91p. Dep. NTIS.

The nucleon-meson transport code NMTC computes the transport of nucleons below 3.5 GeV and muons and charged pions below 2.5 GeV. Monte Carlo methods are employed to provide a detailed description of the transport process. High-energy nucleon-nucleus and pion-nucleus collisions are treated using the intranuclear-cascade-evaporation model. Virtually arbitrary geometries can be specified. The code is written in FORTRAN IV for the IBM 360/75 and IBM 360/91 computers. The method of calculation used by the code is discussed, and the code input is described. Also, input and output for a sample problem are given. (auth)

1531 (SU-1206-231) SOME CONSTRAINTS ON PARTIAL WAVES OF HELICITY AMPLITUDES WHICH FOLLOW FROM ANALYTICITY, UNITARITY, AND CROSSING SYMMETRY. Case, William (Syracuse Univ., N. Y. Dept. of Physics). Aug 1970. 19p. (NYO-3399-231). Dep. NTIS.

Some inequalities involving finite numbers of partial wave helicity amplitudes are derived for the elastic scattering process ab → ab (arbitrary spins and masses). One set of inequalities involves algebraic combinations of t-channel ($a\bar{a} \to b\bar{b}$) partial wave helicity amplitude and holds for any value of t between 0 and $4\mu^2$ (μ is the least mass of the two particles involved in the scattering). A second set places restrictions on integrals over s-channel (ab → ab) partial wave helicity amplitudes. Finally, the above relations are applied to the particular case of π^0-nucleon elastic scattering where inequalities among partial wave helicity amplitudes are obtained. (auth)

1532 (UCRL-19843) REVIEW OF PARTIAL-WAVE ANALYSES OF THE $\bar{K}N$ SYSTEM ABOVE 1.1-GeV/c K^- BEAM MOMENTUM. Barbaro-Galtieri, Angela (California Univ., Berkeley. Lawrence Radiation Lab.). Jun 1970. Contract W-7405-eng-48. 32p. (CONF-700416-9). Dep. NTIS.

From International Conference on Hyperon Resonances, Durham, N. C.

A review of all partial-wave analyses done so far in the mass region 1850 to 2250 MeV is presented. Only the $\Lambda\pi$ and $\Sigma\pi$ channels were analyzed in detail for hyperon states in all partial waves. Some information is also available for the K^-p and $\bar{K}^0n$ systems as well as the ΞK system. A total of four I = 0 states and seven I = 1 states were claimed in this energy region, of which only one and five respectively were seen in at least two channels. The uniqueness of solutions obtained in the analysis of a single channel is discussed. (auth)

1533 (UCSD-10-P-10-76) REDEMPTION OF THE DUAL DESCRIPTION OF PRODUCTION PROCESSES BY UNITARITY. THE RELEVANCE OF THE EIKONAL MODEL. Gunion, John Francis (California Univ., San Diego). 1970. Contract AT-11-1-GEN-10. 85p. Dep. NTIS.

Thesis.

A modified Baker-Blankenbecler type formalism is derived which is used to apply unitarity corrections to the Veneziano model and its generalization to many-point functions. As a result an eikonal-like pole-cut model is obtained for elastic scattering and for production processes. The dip at $t = -0.9$ GeV^2 in K^-p scattering is particularly well described. The processes $K^-p \to \pi^-Y^{*+}$ and $\pi^+p \to K^+Y^{*+}$ are considered in detail and it is found that inclusion of unitarity corrections allows one to retain the assumptions of factorization, exchange degeneracy and duality in contrast to the previous applications of the generalized Veneziano model to these reactions and leads to substantial improvement in the agreement with data. The extension of the model to include spin leads in a natural way to the conservation of s-channel helicity by the Pomeranchuk. (auth)

1534 DETERMINATION OF THE K^{+-} p FORWARD AMPLITUDES AND COUPLING CONSTANTS USING A FINITE-ENERGY RELATION. Martin, A. D. (Univ. of Durham, Eng.); Perrin, R. Nucl. Phys.; B20: 287-300(19700.

The real parts of the amplitudes for $K^{\pm}p$ forward elastic scattering are estimated from the available differential cross section data. A least-squares fit, based on a finite-energy dispersion relation, is performed to these values and the optimum real parts are calculated as a function of energy. From the fit it is found that the KN coupling constants satisfy $g_\Lambda^2 + 0.84\, g_\Sigma^2 = 8.8 \pm 3.0$, a value smaller than that required by SU(3) invariance. Unlike the value of the couplings obtained using the conventional forward dispersion relations, the prediction is not particularly dependent on the model used to extrapolate the K^-p amplitude into the unphysical region. The least-squares fit also provides a sensitive consistency test of the various parameterizations which have been used to analyze the low-energy K^-p scattering data. The test favors the constant scattering length parameterization over the more recent K-matrix parameterizations. In particular, the consistency condition rules out the effective-range K-matrix parameterization due to Kim. (auth)

1535 EQUAL TIME COMMUTATORS OF SPATIAL COMPONENTS OF AXIAL CHARGES AND CORRESPONDING SUM RULES. Komen, G. J.; Pallua, S. (International Centre for Theoretical Physics, Trieste, Italy). Nucl. Phys.; B20: 493-508(1970).

A set of sum rules by saturating the equal-time commutator of integrated space components of axial currents between nucleon states at rest is described. The relation of these sum rules to the SU(6) results is discussed. (auth)

1536 REGGEIZED U(6) ⊗ U(6) ⊗ O(3) ABSORPTIVE PERIPHERAL MODEL FOR $0^-\frac{1}{2}^+ \to 0^-\frac{1}{2}^+$ HYPERCHARGE-EXCHANGE REACTIONS. Collins, P. A.; Hartley, B. J.; Moore, R. W.; Moriarty, K. J. M. (Imperial Coll. of Science and Tech., London). Nucl. Phys.; B20: 381-96(1970).

The $0^-\frac{1}{2}^+ \to 0^-\frac{1}{2}^+$ hypercharge-exchange reactions: $\pi^-p \to K^0\Lambda(\Sigma^0)$, $\pi^-p \to K^0\Lambda$, $K^-n \to \pi^-\Lambda$, $K^-n \to \pi^-\Sigma^0$, $\pi^+p \to K^+\Sigma^+$ and and $K^-p \to \pi^-\Sigma^+$ are studied within the framework of the Reggeized U(6) ⊗ U(6) ⊗ O(3) absorptive peripheral model. The differential cross-section data for $\pi^-p \to K^0\Lambda(\Sigma^0)$ are used to determine the parameters for the $K^*(890)$ and the $K_N(1420)$ exchanges. With these parameters absolute predictions are made for the differential cross sections for the other reactions. Agreement with experiment is reasonable. The polarization parameter P(t) is presented. Good agreement is obtained for $|t| < 0.3$. (auth)

1537 SIMULTANEOUS DESCRIPTION OT TWO- AND THREE-BODY DATA WITH THE GENERALIZED VENEZIANO MODEL. Petersson, B.; Thomas, G. H. (CERN, Geneva). Nucl. Phys.; B20: 451-60(1970).

A generalized Veneziano model which describes the three-body reactions $K^+p \to K^0\pi^+p$, $K^-p \to \bar{K}^0\pi^-p$, and $\pi^-p \to K^0K^-p$ is applied to study the two-body reactions $K^-p \to \bar{K}^0n$, $K^+n \to K^0p$, $\pi^-p \to K^0\Lambda$, $K^-n \to \pi^-\Lambda$, which are given by the three-body amplitude at the nucleon and lambda pole. With no free parameters it is found that with one exception one can give a simultaneous description of these two and three-body reactions at energies between 2.5 and 13 GeV/c, and at all momentum transfers except the extreme forward ($-t < 0.2$ GeV/c^2) and extreme backward ($-u < 0.2$ GeV/c^2) directions. The one exception to this description is briefly discussed. (auth)

1538 DETERMINATION OF THE REAL PART OF THE ρ-NUCLEON SCATTERING AMPLITUDE. Knasel, T. M. (Univ. of Chicago). Phys. Lett.; 33B: 225-6(12 Oct 1970).

The real part of the ρ-nucleon scattering amplitude is determined via a Regge pole type theory from data on the forward production cross section for ρ^0 photoproduction. This result agrees with the real part of photon elastic scattering. (auth)

1539 BACKWARD N_{33}^* PRODUCTION IN πN COLLISIONS AND THE QUARK MODEL. Bialas, A. (CERN, Geneva); Golab-Meyer, Z.; Zalewski, K. Acta Phys. Pol.; B1: 165-72(Apr-Jun 1970).

A quark model of the backward scattering in meson-baryon collisions at high energies is proposed. The predictions for the backward N_{33}^* production in pion-nucleon scattering are given. (auth)

1540 N_{33} RESONANCE AND THE THREE-POLE N/D APPROXIMATION IN THE STATIC MODEL. Krupa, D. (Inst. of Physics, Bratislava). Fyz. Cas.; 19: 129-38(1969).

Within the framework of the N/D method in the static model the forces in the πN channel are usually approximated by two poles corresponding to the N and N* exchanges. A third pole is added and its parameters determined from the requirement of obtaining the correct mass and width for N_{33}^* in the direct channel. The third pole represents in a phenomenological way the forces different from the N and N* exchanges or the corrections

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to their static approximation. The physical interpretation of parameters of the third pole obtained in the calculation is given. The sign of its residue indicates that the third pole represents a correction of the static model and not a resonance exchange contribution. (NSA of Czech.)

1541 BACKWARD π^-p ELASTIC SCATTERING IN THE MOMENTUM RANGE 1.0 TO 5.5 GeV/c. Shanta, R. (Saha Inst. of Nuclear Physics, Calcutta). Nuovo Cim.; 70A: 12-22(1 Nov 1970).

Differential cross sections for backward π^+p elastic scattering and π^-p charge-exchange scattering are analyzed using the resonance model assuming a Breit–Wigner form for the amplitude. The analysis is also carried out in terms of an alternative approach and the relative merits of each approach are discussed. (auth)

1542 POSSIBLE ORIGIN FOR PARITY CONSERVATION IN MESON–NUCLEON SCATTERING. Krisch, Jean P. (Univ. of Michigan, Ann Arbor). Phys. Rev., D; 2: 1751-6(15 Oct 1970).

Parity-nonconserving meson-nucleon scattering is considered and it is shown that self-consistency conditions imposed by a bootstrap-type calculation require that parity be conserved when the meson is pseudoscalar. For a scalar meson, parity is not conserved. (auth)

1543 FEYNMAN-DIAGRAM MODELS OF FERMION DAUGHTER REGGE TRAJECTORIES. Steele, David Univ. of Illinois, Urbana). Phys. Rev., D; 2: 1596-1609(15 Oct 1970).

Some Feynman-diagram models of Regge poles are used to study daughter trajectories of fermions in backward pion-nucleon scattering. Both the simple model with bare propagators and a generalized model that includes propagator self-energy insertions are considered. It is found that, in the simple model, the first daughter is a fixed (as a function of the squared momentum transfer u) double pole in the complex J plane. When self-energy corrections to the propagator are included, the fixed double pole breaks up into a moving daughter trajectory and a moving companion trajectory. It is found that away from u = 0, the daughter and companion trajectories get mixed up in a complicated and model-dependent manner. (auth)

1544 HARD-PION CALCULATION OF SINGLE-PION PRODUCTION IN PION–NUCLEON SCATTERING. Koeberle, R. (Univ., Sao Paulo, Brazil). Nucl. Phys.; B21: 541-50(1970).

$\pi\pi$ Scattering information is extracted from the reaction $\pi N \to 2\pi N$ by means of a hard-pion calculation, satisfying the algebra of fields and PCAC. Several models for $\pi\pi$ scattering are compared with the data for $\pi^-p \to \pi^+\pi^-n$. To get good agreement an I = 0 σ-meson seems to be required with $m_\sigma \simeq m_\rho$ and $\Gamma_\sigma \simeq 200$ MeV, the pion thus transforming linearly under SU(2) × SU(2). The resulting $\pi\pi$ scattering lengths are: $a_0 = 0.158\ \mu_\pi^{-1}$ and $a_2 = -0.04\ \mu_\pi^{-1}$. (auth)

1545 USING CROSSING AND CHARGE SYMMETRY WITH THE GENERALIZED VENEZIANO MODEL IN THE $\pi K\bar{K}N\bar{N}$ SYSTEM. Raitio, R. O. (Univ. of Helsinki). Nucl. Phys.; B21: 427-35(1970).

The generalized Veneziano model is applied to study the reactions $K^+n \to K^0\pi^+n$ and $K^-n \to \bar{K}^0\pi^-n$ which are related by crossing and charge symmetry to four other meson–proton reactions of the type $\pi K\bar{K}N\bar{N}$ which have been analyzed previously. Similar agreement as in the previous work is obtained. Thus altogether six reactions have been studied successfully at different energies with essentially one parameter. (auth)

1546 ANALYSIS OF NUCLEON RESONANCES BELOW 2 GeV. Davies, A. T. (Univ. of Glasgow). Nucl. Phys.; B21: 359-80(1970).

A solution was found for pion–nucleon phase-shifts between pion kinetic energy 310 and 1450 MeV. Guided by this a fit was obtained with the partial waves parametrized as resonances plus background. Values of the resonance parameters are proposed. (auth)

1547 MODEL OF COUPLING-CONSTANT RENORMALIZATION. Wilson, Kenneth G. (Cornell Univ., Ithaca, N. Y. Stanford Univ., Calif.). Phys. Rev., D; 2: 1438-72(15 Oct 1970).

The charged scalar theory of π mesons interacting with a fixed nucleon source is truncated as follows: π mesons are permitted to exist only in a set of discrete state $\psi_m(k)$ such that k is of order Λ^m in the state $\psi_m(k)$; Λ is an arbitrary constant above 4×10^6. Also, two mesons of the same charge cannot occupy the same state. The resulting Hamiltonian can be solved by a perturbation expansion in Λ^{-1} provided there are only a finite number M of states ψ_m. When $M \to \infty$, the renormalized coupling constant and ground-state energy diverge in perturbation theory (in the coupling constant). If the unrenormalized coupling constant is allowed to go to infinity as $M \to \infty$, it is proven that the renormalized theory exists (without ghost states) for any value of the renormalized coupling constant. The proof uses the perturbation analysis in Λ^{-1} carried to all orders. This analysis leads to the definition of a transformation T which eliminates one meson degree of freedom from any given Hamiltonian, replacing it by an effective Hamiltonian with one less degree of freedom. The effective Hamiltonian gives exactly all energy levels of the original Hamiltonian except those with mesons in the removed degree of freedom. The renormalizability of the theory is proven using topological properties of T. In particular, there is a subtransformation T_A with a nontrivial fixed point P_c whose properties determine the principal features of the renormalized theory. The idea of the fixed point is a generalization of the Gell–Mann–Low eigenvalue condition for the bare coupling constant of quantum electrodynamics. (auth)

1548 BACKWARD PION–NUCLEON CHARGE EXCHANGE DATA AND N_γ CONTRIBUTION. Schneider, J. (Institut de Physique Nucleaire, Orsay, France); Schiff, D.; Tran Thanh Van, J. Lett. Nuovo Cim.; 4: 727-34(17 Oct 1970).

Two catagories of Regge cut models are considered for backward π + N scattering. They are the cut model with nonsense wrong-signature zeros in the Regge residues for weak or strong cuts and no nonsense wrong-signature zeros for strong cuts. The processes $\pi^+ + p \to p + \pi^+$, $\pi^- + p \to p + \pi^-$, and $\pi^- + p \to n + \pi^0$ are considered. It is shown that the contribution of N_γ is constrained to be strongly absorbed ($\lambda \simeq 2$) and to have a dip between −0.15 and −0.25. (J.F.P.)

1549 WARD-IDENTITY TECHNIQUES AND LOW-ENERGY PION–NUCLEON SCATTERING. Osypowski, Edward T. (Univ. of Wisconsin, Madison). Contract AT(11-1)-881. Nucl. Phys.; B21: 615-58(1970).

A study is made of the low-energy s- and p-wave πN partial-wave amplitudes calculated from an expansion of the on-mass-shell πN scattering amplitude to second order in the pion four-momenta. The starting point for the expansion is an expression for the scattering amplitude obtained by applying Ward-identity techniques to three- and four-point functions composed of isotopic vector currents and nucleon field operators obeying postulated equal-time commutation rules. Numerical estimates for the three important expansion parameters are obtained by comparing the sum of the known N, ρ, N*(1236) contributions to the s- and p-wave scattering lengths and the s-wave effective ranges with experiment. The resultant amplitudes give good agreement with the experimentally determined partial-wave amplitudes at T_π = 58 MeV. The values obtained for the non-pole parameters imply a significant contribution from the σ-commutator. (auth)

1550 VERIFICATION OF THE MODELS OF THE ASYMPTOTIC BEHAVIOR OF THE AMPLITUDES OF K^+p SCATTERING. Dumbrais, O. V.; Queen, N. M. (Joint Inst. for Nuclear Research, Dubna, USSR). JETP Lett. (USSR) (Engl. Transl.): 12: 133-5(20 Aug 1970).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 12: 191-3(20 Aug 1970).

It is shown that by using a simple sum rule it is possible to limit considerably the number of different parametrizations for the asymptotic behavior of the amplitudes for K^+ + p interactions. (J.F.P.)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 979 and 1641.

1551 (BNL-tr-358) GLAUBER CORRECTIONS AND THE INTERACTION BETWEEN HIGH ENERGY HADRONS AND NUCLEI. Gribov, V. N. Translated by S. J. Amoretty (Brookhaven National Lab., Upton, N. Y.), from Zh. Eksp. Teor. Fiz.; 56: 892-901(1970). 21p. Dep. NTIS.

It is pointed out that the arguments leading to the $A^{\frac{1}{3}}$ law for the nuclear cross sections and the equation for the total cross section including the Glauber correction for scattering by a deuteron are essentially nonrelativistic in character. The conditions for the applicability of the nonrelativistic theory, and screening at very high energies, are discussed. Pion–deuteron scattering is considered. (J.F.P.)

1552 (JINR-E2-5282) INELASTIC INTERACTIONS OF PARTICLES AND NUCLEI AT HIGH AND SUPERHIGH ENERGIES. Barashenkov, V. S.; Il'inov, A. S.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR . Lab. of Theoretical Physics). 1970. 38p. Dep. NTIS (U. S. Sales Only).

The methods and the results of the cascade calculations of inelastic interactions of particles and nuclei in the energy range from several dozens of MeV to several thousands of GeV are discussed. The discussion is based mainly on the work performed at Dubna. Special attention is paid to the cases in which the calculations performed by the usual cascade model are in

disagreement with experiment. Various ways of improving the theory are considered, in particular, the account of the change of the nuclear density as the cascade particle shower develops. (auth)

1553 ELECTROMAGNETIC STRUCTURE AND COULOMB CORRECTIONS TO STRONG INTERACTIONS. Oades, G. C. (Rutherford High Energy Lab., Chilton, Eng.); Rasche, G. Nucl. Phys.; B20: 333-53(1970).

A divergence free treatment of Coulomb corrections for the scattering of two spin-0 particles with extended charge distributions is presented. The outer Coulomb corrections are treated non-relativistically to all orders in the Coulomb parameter but in the case of the inner Coulomb corrections restrictions are made to a perturbation treatment and only a first-order result is obtained. The treatment, including first-order relativistic corrections, is applied to a re-analysis of low-energy $\pi^{\pm}$^{4}He scattering. (auth)

1554 BINDING ENERGY OF A Λ PARTICLE IN NUCLEAR MATTER WITH THE NEW HERNDON–TANG Λ–N POTENTIALS. Dabrowski, J. (Univ., Warsaw. Inst. for Nuclear Research, Warsaw); Hassan, M. Y. M. Acta Phys. Pol.; A38: 429-31(Sep 1970).

The binding energy of a Λ particle in nuclear matter, $B_\Lambda(\infty)$, was calculated with the new Λ–N potentials of Herndon and Tang. The resulting values of $B_\Lambda(\infty)$ lie between 38.7 and 49.5 MeV. Thus, with the new potentials, the problem of overbinding of a Λ particle in nuclear matter remains essentially unchanged. (auth)

1555 ANALYSIS OF THE SCATTERING π^-–^{12}C AROUND THE N* RESONANCE. Krell, M.; Barmo, S. (Univ., Sherbrooke, Quebec). Nucl. Phys.; B20: 461-75(1970).

Measurements of the elastic scattering π^-–^{12}C between 120 and 280 MeV permit an investigation of the Kisslinger–Ericson π-nuclear optical potential around the (3,3) resonance. For this analysis nearly all parameters are assumed to be fixed by other reliable measurements resp. evaluations, apart from two parameters for the strength of the gradient potential (complex c_0). The lines of equal χ^2 in the complex c_0 plane are explored and two solutions are found. One of them can be interpreted as the physical solution. (auth)

1556 STUDY OF THE REACTION pp → ρΔN AT 19 GeV/c. Boeggild, H. (Univ. of Copenhagen); Eades, J.; Hansen, K.; (and others). Nucl. Phys.; B20: 441-50(1970).

Production of ρ-mesons in several charge states was observed in 19 GeV/c pp collisions leading to five-body final states, pp → $np\pi^+\pi^+\pi^-$ and pp → $pp\pi^+\pi^-\pi^0$. A strong association with simultaneous production of Δ(1236) is found. The estimate of the total cross section, summed over all five possible charge configurations is $\sigma(pp \to \rho\Delta N) = 0.57 \pm 0.07$ mb. These reactions seem to account for most of the ρ-production. The partial reaction channel pp → $\rho^0\Delta^{++}n$ with a cross section of 194 ± 35 μb was studied in some detail. The data do not support the existence of the decay of a Δ(≈ 1900) resonance via ρ^0(765). The fractions of the total cross section going into each partial channel with specified charges of ρΔN are compared with the predictions of various isospin coupling models. (auth)

1557 N/D UNITARY ISOBAR MODEL OF NN–NN*. II. Bruno, Daniel R. O.; Duck, Ian M. (Rice Univ., Houston, Tex.). Nucl. Phys.; B20: 354-68(1970).

The effect on NN $^1S_0$ and $^1D_2$ phase shifts of OPE coupling to the NN* channel is calculated. An N/D unitary isobar model taking account of complex singularities due to the instability of the N* is used. The NN* coupling provides almost enough attraction to make the σ-meson contributions unnecessary to the $^1S_0$, and causes a resonance in the $^1D_2$ just below the inelastic threshold. (auth)

1558 ANGULAR DISTRIBUTION OF THE REACTION $_1$H(d,^{3}He)γ. Gibson, B. F.; O'Connell, J. S. (National Bureau of Standards, Washington, D. C.). Phys. Lett.; 32B: 331-2(3 Aug 1970).

The angular distribution of the proton–deuteron radiative capture cross section is calculated using the plane wave form of the electromagnetic interaction operator and model wave functions for the ^{3}He S,S′ and D-states and a plane wave continuum state. (auth)

1559 MULTI-REGGE ANALYSIS OF THE pp → $pp\pi^+\pi^-$ REACTION AT 8.1 GeV/c. Boratav, M. (Institut de Physique Nucleaire, Paris); Le Guyader, J.; Sene, M.; (and others). Nucl. Phys.; B20: 573-91(1970).

An analysis of the reaction pp → $pp\pi^+\pi^-$ at 8.1 GeV/c is presented in terms of the two multi-Regge models proposed by Chan, Łoskiewicz and Allison and by Berger et al. in which some modifications are introduced to improve the agreement between experimental data and theoretical results. Comparison between various experimental distributions and corresponding theoretical curves is satisfactory with a very simple parametrization in both models. (auth)

1560 HIGH ENERGY NEUTRON–NUCLEUS TOTAL CROSS SECTION. Bochman, G. V. (McGill Univ., Montreal); Kofoed-Hansen, O.; Margolis, B. Phys. Lett.; 33B: 222-4(12 Oct 1970).

The total neutron cross section on nuclei is calculated from 5 to 21 GeV/c and compared with experiment. One can only tolerate a modest amount of regenerative amplitudes, following diffractive production. Arguments are given for including only intermediate N* states in the diffractive production component. (auth)

1561 VENEZIANO MODEL FOR NUCLEON NUCLEON AND NUCLEON ANTINUCLEON SCATTERING. I. Muetter, K. H. (Freie Univ., Berlin). Z. Phys.: 239: 30-40(1970).

A tu crossing symmetric description of the NN and N$\bar{\text{N}}$ scattering is proposed by means of a Veneziano model for the meson trajectories in the two N$\bar{\text{N}}$ channels. It is shown that the exchange degenerate parent trajectories $\alpha_\rho(t) = \alpha_{A_2}(t)$ and $\alpha_\omega(t) = \alpha_f(t)$ do not have ancestors and parity partners in the model. The factorization theorem holds for the residues of the parent trajectories in both N$\bar{\text{N}}$ channels t and u. (auth)

1562 MULTIPLICITY, ASYMMETRY, AND INELASTICITY IN ULTRAHIGH-ENERGY N–N INTERACTIONS. Shivpuri, R. K. (Clarkson Coll. of Tech., Potsdam, N. Y.). Lett. Nuovo Cim.; 4: 741-6(17 Oct 1970).

It is pointed out that some features of ultrahigh-energy N + N interactions are anomalous and cannot be described by the fireball model or the Fermi model. These features, the very low multiplicity and wide distribution in asymmetry and inelasticity, are accounted for by means of the parton model. (J.F.P.)

1563 FLAT POMERON, THE WU–YANG HYPOTHESIS, AND A MODEL FOR HIGH-ENERGY PROTON–PROTON SCATTERING. Kohsaka, Y.; Takagi, F. (Tohoku Univ., Sendai). Lett. Nuovo Cim.; 4: 747-53(17 Oct 1970).

The possibility of retaining the idea that the Pomeron is flat and its residue is correlated to the product of the electromagnetic form factors of relevant hadrons is investigated from a phenomenological point of view. It is found that a good fit is obtained to all the data on the p–p scatterings within the framework of the model. (J.F.P.)

1564 INTERACTION OF TWO FREE NUCLEONS. Moravcsik, M. J. (Univ. of Oregon, Eugene. International Center of Theoretical Physics, Trieste, Italy). Magy. Fiz. Foly.; 18: 229-48(1970). (In Hungarian).

The current state of our knowledge about the interaction of 2 free nucleons is reviewed, starting from well-known general principles and leading to more specific dynamic assumptions; this allows to gain insight in the reaction mechanism. The proton-scattering phenomena in the 0 to 400 MeV range may be unequivocally described; the results may be used quantitatively. The neutron–proton scattering is not known as well; below 50 MeV the phases cannot be determined even qualitatively and there are serious uncertainties in the 200 to 400 MeV range. From the experimental viewpoint, the neutron–neutron scattering is practically unknown. The charge symmetry is well established by the validity of the symmetries and assumed to be energy dependent. It might be of interest to carry out direct measurements on n–n scattering. At low energies, the n–n scattering may be investigated by studying the collision of neutron beams in high-flux reactors or in underground nuclear explosions. Development of the so-called "meson factories" will be a great assistance in such studies. (TTT)

1565 SELF-CONSISTENT APPROXIMATIONS OF THE GREEN'S FUNCTION OF A Λ-HYPERON IN NUCLEAR MATTER. Gans, Ingbert (Justus Liebig-Univ., Giessen, Ger.). Z. Phys.; 239: 83-94(1970). (In German).

An iteration procedure is derived for determining a self-consistent approximation for the one-particle Green's function in any order, starting from perturbation theory. This method is used to calculate the second Born approximation of the self energy of a Λ-particle in nuclear matter. After one iteration the approximation is nearly self-consistent. The value of the binding energy of the Λ-particle is only slightly decreased from the value of perturbation theory. Because of the vanishing particle density of the Λ-hyperon, the quasiparticle energy depends on the square of the momentum k, the width of the spectral function is proportional to k^4 and the imaginary part of the self energy operator is proportional to $(\omega - \mu)^{3/2}$ for ω approaching the chemical potential μ. (auth)

1566 MODIFICATION OF THE GLAUBER FORMULA FOR VIOLATION OF THE POMERANCHUK THEOREM. Violini, G.;

Queen, N. M. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 59: 934-6(Sep 1970). (In Russian).

It is pointed out that the usual form of the Glauber formula for total deuteron cross sections breaks down if the Pomeranchuk theorem is violated. A simple modification of it is derived for this case. Assuming the validity of the Okun–Pomeranchuk theorem, under general conditions the Glauber correction reduces asymptotically to $\delta\sigma = 2\sigma_{el}$, where σ_{el} is the total elastic cross section for scattering by nucleons. (auth)

1567 HYPERON–NUCLEON INTERACTION. Satoh, E.; Nogami, Y. (McMaster Univ., Hamilton, Ont.). Phys. Lett.; 32B: 243-5(6 Jul 1970).

Phenomenological potentials for the hyperon-nucleon interaction are set up which fit the low-energy ΛN and ΣN scatterings including the Λp resonance below the ΣN threshold. Then the binding energy of a Λ-particle in nuclear matter is calculated. (auth)

1568 HIGH-ENERGY SCATTERING OF PROTONS BY NUCLEI. Glauber, R. J. (Harvard Univ., Cambridge, Mass.); Matthiae, G. Nucl. Phys.; B21: 135-57(1970).

The theory of high-energy hadron-nucleus collisions is discussed by means of the multiple-diffraction theory. Effects of the Coulomb field are accounted for in elastic scattering by light and heavy nuclei. Inelastic scattering is treated by means of the shadowed single collision approximation at small momentum transfer and the corresponding multiple collision expansion at large momentum transfers. The theory is compared with the measurements of Bellettini et al. on proton-nucleus scattering at 20 GeV/c by finding density distributions for the nuclei which provide least-squares fits to the data. The nucleon densities found are closely comparable in dimensions to the known charge densities. The predicted sums of the angular distributions of elastic and inelastic scattering reproduce the experimental angular distributions fairly closely. (auth)

1569 VENEZIANO MODEL FOR NUCLEON–NUCLEON AND NUCLEON–ANTINUCLEON SCATTERING. II. THE HIGH-ENERGY BEHAVIOR. Muetter, K.-H.; Traenkle, E. (Freie Univ., Berlin). Z. Phys.; 239: 211-22(1970).

Within the frame work of a Veneziano model for invariant functions a description of the NN and NN̄ data at high energies is presented. Except for the Pomeron and the π pole, which is considered to be elementary, two exchange degenerate trajectories are needed: $\alpha_\omega(t) = \alpha_f(t) = 0.2 + 1.4t$ and $\alpha_c(t) = -0.2 + 1.0t$. The crossover of the pp and pp differential cross sections is achieved by a zero for the ωf trajectory. The conspirator $\alpha_c(t)$ is responsible for the pn → np and pp → nn forward peaks and the pp → pp and pp → pp polarizations. (auth)

1570 CAPTURE OF K^- MESONS IN THE NUCLEAR PERIPHERY. Bethe, H. A. (Cornell Univ., Ithaca, N. Y.); Siemens, P. J. Nucl. Phys.; B21: 589-605(1970).

The rates of nucleonic absorption of K^- mesons from their atomic orbitals are estimated. It is found that both the X-ray intensities and the final charge states observed experimentally can be explained by taking into account: (a) the extrapolation of the KN scattering amplitudes to the relevant kinematical region; and (b) the fact that, in heavier nuclei, the protons' single-particle wave functions decay more rapidly than the neutrons' because of the Coulomb barrier. Distinction is made between the main nuclear surface (near the half-density point) where neutron and proton distributions are similar and where alpha clustering may be significant, and the distant nuclear surface where much of the mesic absorption by single nucleons occurs. (auth)

Particle Invariance Principles and Symmetries

Refer also to abstracts 1475 and 1597.

1571 (AD-706833) GENERALIZATION OF THE CONCEPT OF BOSON: THE SYMPLECTON. Biedenharn, L. C.; Louck, James D. (Duke Univ., Durham, N. C. Dept. of Physics). 1970. 28p. NTIS.

By explicit construction a primitive minimal realization of the SU(2) approximately equal to Sp(2) symmetry group in terms of a single boson operator is demonstrated. The construction denies the usual boson rule, and as such constitutes a true generalization of the concept of boson. The resulting inherently conjugation-symmetric structure is denoted as a symplecton. (auth)

1572 (ITF-70-55) WIGNER–ECKART THEOREM FOR THE LOCALLY COMPACT GROUP. Klimyk, A. U. (Akademiya Nauk Ukrainskoi SSR, Kiev. Institut Teoreticheskoi Fiziki). 1970. 11p. Dep. NTIS (U. S. Sales Only).

The Wigner–Eckart theorem for the matrix elements of tensor operator transformed according to the unitary irreducible representation of locally compact (noncompact) group is proven. (auth)

1573 (SU-1206-228) SOME NEW RESULTS ON SYMMETRY BREAKING IN A CHIRAL MODEL. Schechter, J.; Ueda, Y. (Syracuse Univ., N. Y. Dept. of Physics). Jul 1970. 11p. (NYO-3399-228). Dep. NTIS.

The mass spectrum of the spin-zero mesons is investigated in a very general chiral SU(3) ⊗ SU(3) model. A striking tendency for the ninth pseudoscalar mass to come out in the right region is noted. Electromagnetic symmetry breaking is included and the meson electromagnetic mass shifts can be correlated with those of the baryons when the strength of the electromagnetic symmetry breaking is the same order of magnitude as the chiral breaking. (auth)

1574 (SU-1206-229) ELECTROMAGNETIC PERTURBATION OF THE PSEUDOSCALAR MASS SPECTRUM. Schechter, J.; Ueda, Y. (Syracuse Univ., N. Y. Dept. of Physics). Jul 1970. 28p. (NYO-3399-229). Dep. NTIS.

Using the formalism developed previously electromagnetic perturbations are investigated in a rather general chiral SU(3) ⊗ SU(3) model of mesons. The meson and octet baryon mass shifts can be successfully correlated and it is found that the electromagnetic breaking term in the Lagrangian is of the same order of magnitude as the chiral symmetry breaking term. Also the speculation that all strong symmetry breaking may be of electromagnetic and weak origin is discussed. (auth)

1575 (SU-1206-230) SYMMETRY BREAKING AND SPIN ZERO MASS SPECTRUM. Schechter, J.; Ueda, Y. (Syracuse Univ., N. Y. Dept. of Physics). Jul 1970. 35p. (NYO-3399-230). Dep. NTIS.

The mass spectrum is discussed in a very general chiral SU(3) × SU(3) model of pseudoscalar and scalar mesons. The case of an exactly symmetric Lagrangian and spontaneous breakdown is covered as well as the more realistic case when there is also some intrinsic symmetry breaking in the Lagrangian. The treatment is facilitated by the derivation of a mass formula which holds for all situations. In the realistic case the structure of the theory forces the mass of the ninth pseudoscalar meson to come out right and leaves one with the freedom to choose the masses of all scalar mesons (except the kappa) as high as one likes. The structure of the intrinsic symmetry breaking term is predicted. Some discussion of the baryons in this model is also included and the corrections to the Cabibbo theory of semi-leptonic hyperon decay are estimated. (auth)

1576 DYNAMICAL CONSEQUENCES OF SPONTANEOUS BREAKDOWN OF SYMMETRIES. Ferrari, R. (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France); Picasso, L. E. Nucl. Phys.; B20: 553-64(1970).

The spontaneous breakdown of a continuous symmetry group generated by conserved currents is considered. In the framework of general quantum field theory the possible dynamical consequences of spontaneous breakdown are analyzed: a general relation is derived between n- and (n + 1)-point functions involving Goldstone bosons in the limit of zero momentum. The technique is illustrated by a few examples for the SU(2) × SU(2) chiral group and the results generalize relations known from the perturbative treatment of the σ-model. (auth)

1577 ALGEBRAIC REALIZATION OF UNITARY SYMMETRY. Ogievetskii, V. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Lett.; 33B: 227-9(12 Oct 1970).

The algebraic realization of Weinberg of the SU_3 symmetry is considered. The necessity of nonets is motivated. The mass sum rules derived are satisfied to a great accuracy for the well established supermultiplets providing new predictions for nonets in which not all the members are established to date. (auth)

1578 MULTIPLICITIES IN THE CLASSICAL GROUPS. I. Gruber, B. (Saint Louis Univ.). J. Math. Phys. (N. Y.); 11: 3077-90(Oct 1970).

A unified treatment of all three multiplicities, valid for all classical (compact, connected, simple Lie) groups, is described. The general theory is given and then applied to the rank-2 groups. (auth)

1579 LABELING STATES AND CONSTRUCTING MATRIX REPRESENTATIONS OF G_2. Patera, J. (Univ. of Montreal). J. Math. Phys. (N. Y.); 11: 3027-32(Oct 1970).

A method is developed for labeling G_2-internal states and for finding the matrices representing G_2-generators. The simple Lie algebra G_2 is embedded into A_4, whose representation spaces are

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labeled by Gel'fand patterns. For a given irreducible finite-dimensional representation $\Psi(G_2)$ of G_2, an optimal representation $\Phi(A_6) \supset \Psi(G_2)$ is chosen, and a lemma is formulated which enables us to select the subspace $R(\Psi)$ from the representation space $R(\Phi)$ (auth)

1580 REDUCTION OF A CLASS OF O(4,2) REPRESENTATIONS WITH RESPECT TO SO(4,1) AND SO(3,2). Barut, A. O. (Univ. of Colorado, Boulder); Boehm, A. J. Math. Phys. (N. Y.); 11: 2938-45(Oct 1970).

A complete classification of representations of SO(4,2) with infinitesimal generators S_{AB}, characterized by the representation relation $\{S_{AB}, S_{CD}\} = -2ag_{BC}$, and their extension by parity were determined. The possible values of a are $a = 1 - S^2$, $S = 0, \frac{1}{2}, 1, \frac{3}{2}, 2, \cdots$. These representations were then reduced according to the two chains $SO(4, 2) \supset SO(4, 1) \supset SO(4) \supset SO(3)$ and $SO(4, 2) \supset SO(3, 2) \supset SO(3) \otimes SO(2)$. The equivalence of these representations with the oscillator representations is established. (auth)

1581 MEASUREMENT OF THE BRANCHING RATIO $K_L^0 \to 2\pi^0$ TO $K_L^0 \to 3\pi^0$. Faissner, H. (Technische Hochschule, Aachen); Reithler, H.; Thome, W.; (and others). Nuovo Cim.; 70A: 57-69 (1 Nov 1970).

The branching ratio of $2\pi^0$ to $3\pi^0$ decays of the long-lived neutral kaon was determined. The number of $2\pi^0$ events was taken over from the previous analysis of the CERN-RHEL-Aachen group. A sample of $3\pi^0$ decays was collected using events with six visible showers only. The background in the sample was shown to be negligible; the main uncertainty arises from the recognition of 6-shower events. Allowing for this uncertainty, and for systematic effects in extracting the $2\pi^0$ signal, the branching ratio found is $(0.90 \pm 0.30)(10^{-2})$. This corresponds to a value of the CP-violating parameter $|\eta_{00}| = (3.2 \pm 0.5)(10^{-3})$. (auth)

1582 MASS RELATIONS IN BROKEN SU(3). Krori, K. D. (Cotton Coll., Gauhati, India). Indian J. Pure Appl. Phys.: 7: 523-5(Aug 1969).

A number of mass relations in broken SU(3) were derived from the simple premise that the mass operator consists of a symmetry-abiding term plus the symmetry-breaking and electromagnetic interaction terms. These relations include the well-known mass formulas as well as the new mass formulas obtained previously on the basis of Fubini–Furlan dispersion relation for current commutator. (auth)

1583 INTERMEDIATE VECTOR MESONS, UNITARY SYMMETRY, AND THE CP VIOLATION. Tomozawa, Yukio (Univ. of Michigan, Ann Arbor). Phys. Rev., D; 2: 1586-91(15 Oct 1970).

A model of the weak-interaction Lagrangian based on SU_3 symmetry and the assumed existence of intermediate vector mesons (W mesons) is presented. The requirement that the effective Lagrangian resulting from contraction of the W mesons should induce no $|\Delta S| = 2$ transition in the lowest order leads to the assumption of complex values for some of the coupling constants, which implies that the model is intrinsically CP violating. The effects of the CP violation will be found in processes of W-meson production or those involving higher orders in the Fermi coupling constant G_F. As far as the K^0-$\bar{K}^0$ system is concerned, the prediction of the model is similar to that of a superweak theory, although in this model the observed CP violation is due to a combined effect of the higher-order weak interactions and the other CP-conserving but SU_3-symmetry-breaking interactions (such as the electromagnetic and the medium-strong interactions). Some other possibilities for the cause of CP violation are also discussed, in which case the prediction is not necessarily the same as that of a superweak theory. The Cabibbo angle is defined as the ratio between the coupling constants of the SU_3-symmetric and symmetry-breaking hadronic terms of the weak interactions. (auth)

1584 PION PRODUCTION AND THE ALGEBRAIC REALIZATION OF CHIRAL SYMMETRY. Ahmed, M. A. (International Atomic Energy Agency, Vienna. International Centre for Theoretical Physics, Trieste, Italy). Phys. Rev., D; 2: 1741-50(15 Oct 1970).

Single-pion production is treated within the framework of the algebraic realization of chiral symmetry introduced by Weinberg. The objective is to test the consistency of Weinberg's hypotheses and procedure and to see if further restrictions on the axial-vector helicity coupling and the mass matrices result. It is concluded that the procedure is consistent, at least in the case of production of a single pion in pion-target collision processes. (auth)

1585 INTERPRETATION OF A DISCRETE SYMMETRY IN BROKEN SU(3) x SU(3). Kuo, T. K. (Purdue Univ., Lafayette, Ind.). Phys. Rev., D; 2: 1761-2(15 Oct 1970).

In connection with a discrete symmetry proposed recently, various possible interpretations are examined. It is concluded that modification of the $(3,\bar{3}) + (\bar{3},3)$ symmetry-breaking model is the most likely solution. (auth)

1586 CAUSALITY AND FASTER THAN LIGHT PARTICLES. Csonka, Paul L. (Univ. of Oregon, Eugene). Nucl. Phys.; B21: 436-44(1970).

No argument is given either for nor against the existence of faster than light particles in nature. An attempt is made to resolve the controversy concerning whether such particles are compatible with retarded causality. (auth)

1587 SPECTRAL FUNCTION SUM RULES AND (8,8) SYMMETRY BREAKING. Genz, H. (Univ., Karlsruhe, Ger.); Katz, J. Nucl. Phys.; B21: 333-45(1970).

Spectral function sum rules are derived in an (8,8) model of $SU(3) \otimes SU(3)$ symmetry breaking. Although perfect $SU(2) \otimes SU(2)$ symmetry is excluded, it is shown that if one assumes isoscalar pion σ-terms Weinberg's sum rules for $SU(2) \otimes SU(2)$ then approximately follow. Solutions in agreement with positivity and experimental data are shown to exist and are briefly discussed. (auth)

1588 RELATIONSHIP BETWEEN CHIRAL AND DUAL MODELS. Ellis, J.; Renner, B. (Cambridge Univ., Eng.). Nucl. Phys.; B21: 205-16(1970).

An attempt is made to help clarify the observed coincidences between predictions from chiral and dual models in the low-energy domain. Frye and Susskind have suggested that it may be possible to reconstruct the tree graphs of the nonlinear σ-model from certain general properties of the amplitudes, which are satisfied in the Veneziano model, but much weaker than the Veneziano model itself. This construction is completed for pion theories with the nonlinear σ-model as a natural solution, and the construction is extended to theories involving K- and η-mesons. The immediate generalization of the pion theory leads to a nonet model with ideal mixing of pseudoscalar mesons, the latter being a well known difficulty in dual models. Weakening certain technical constraints, which may not be of general physical significance, a generalized σ-model with eight pseudoscalar mesons is presented as an alternative solution. (auth)

1589 TRANSFORMATION MATRICES BETWEEN THE U_3 contains U_2 AND U_3 contains O_3 CHAINS. Wolf, Kurt Bernardo (Tel-Aviv Univ., Israel). Rev. Mex. Fis.; 19: 206-25(1970).

The transformation matrices between the bases for irreducible representations of the U_3 group classified by the $U_3 \supset U_2 \supset U_1$ (canonical) and the $U_3 \supset O_3 \supset O_2$ (orbital) chain decompositions were computed directly. The results, for all representations up to order six, are presented as (square roots of) rational numbers. (auth)

1590 COMPOSITE STATES FOR FOUR-FERMION INTERACTIONS BY THE METHOD OF BROKEN SYMMETRIES. Mueller, H. J. W. (Univ., Munich). Nucl. Phys.; B21: 493-504(1970).

Composite states are studied in the frame of a non-linear spinor theory with two simultaneously broken symmetries. Broken chiral or Lorentz invariance implies a degeneracy of the vacuum. Moreover if a gauge term consisting of an Abelian-gauge-type vector field Q_μ coupled to a conserved vector current is added to the free Lagrangian, so that the modified free Lagrangian is gauge invariant whereas the interaction is not, it is seen that the condition for broken gauge invariance is identical with the condition of broken Lorentz invariance. The field Q_μ and the mass of the fermion quasi-particles (nucleons) are determined self-consistently in a Hartree–Fock approximation. The compatibility of these equations is examined for specific models and the homogeneous Bethe–Salpeter equation for quasiparticle-antiquasiparticle excitations is then solved. The Nambu and Bjorken models are found to contain a massless vector state (photon) and a massive pseudoscalar particle (pion). The Bopp model, however, contains instead of the vector an axial-vector state. (auth)

1591 CURRENT ALGEBRA CALCULATION OF ($\pi\pi$) s-WAVE PHASE SHIFTS. Collins, P. V. (Cambridge Univ., Eng.). Nucl. Phys.; B21: 577-88(1970).

Chiral SU(2) × SU(2) current algebra and assumptions on chiral symmetry breaking are used to generate a set of Ward identities involving the ($\pi\pi$) s-wave for factor. Following a method recently proposed by Brehm, Golowich and Prasad, unitarity is retained and through an integral equation the ($\pi\pi$) s-wave phase shifts in the isospin zero channel are estimated. The results depend on one parameter, which we fix by using an effective σ-mass as input, and unitarity corrections to Weinberg's scattering length dependent on the σ-mass are obtained. (auth)

Field Theories

General

1592 MACROSCOPIC PROPERTIES OF DENSE NON-CAUSAL MATTER. Cutkosky, R. E. (Carnegie-Mellon Univ., Pittsburgh). Phys. Rev., D; 2: 1386-9(15 Oct 1970).

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The noncausal matter described by an indefinite-metric field theory provides, at very high densities, a possibility that low-frequency sound waves might propagate with a speed which greatly exceeds the speed of light, and a possibility that the pressure might exceed the relativistic energy density. (auth)

1593 STUDY OF THE METRICS OBTAINED BY VARYING THE CONSTANTS OF THE KERR METRIC. Martin, Jesus; Mas, Luis (Univ., Paris). Compt. Rend., Ser. A; 271: 338-40(3 Aug 1970). (In French).

The possibility of widening the application of the Kerr metric to cases other than empty space by varying the constants was studied. In particular, a solution was found for the case of an electromagnetic field. (France)

Quantum Field Theory

Refer also to abstract 1348.

1594 (AD-706929) AXIOMATIC QUANTUM FIELD THEORY AND SCATTERING OF ELEMENTARY PARTICLES. Final Report. Toll, John S. (State Univ. of New York, Stony Brook. Dept. of Physics). 31 Mar 1970. 16p. (AFOSR-70-1229-TR). NTIS.

The final report is given on a research project at the State University of New York at Stony Brook on axiomatic quantum field theory and scattering of elementary particles. The consequences of analyticity in quantum field theory that results from strict causality, Lorentz invariance, positivity of energy, unitarity, and other fundamental axioms of quantum field theory are explored. The results include a general proof from the axioms that any quantum field theory with nontrivial scattering must include at some energies nontrivial production as well. A general proof was given of the superconvergence relations and related analytic properties, including the case of particles with spin. Other restrictions on high energy scattering were derived. (auth)

1595 (DESY-70/30) PROPERTIES OF SUPER-PROPAGATORS IN LAGRANGIAN QUANTUM-FIELD THEORY WITH EXPONENTIAL INTERACTIONS. Karowski, Michael (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Jul 1970. 40p. (In German). Dep. NTIS (U. S. Sales Only).

The "super-propagator" for any mass in a field theory with an exponential interaction Lagrangian is defined. Several integral representations are derived. The analytic properties with respect to the coupling constant and the asymptotic behavior in momentum space are investigated. (auth)

1596 (DESY-70/43) SMALL-DISTANCE BEHAVIOUR IN FIELD THEORY. Symanzik, K. (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Sep 1970. 19p. Dep. NTIS (U. S. Sales Only).

The small-distance behavior in quantum field theory in the sense of overall scaling is studied with the help of the infinitesimal operation to mass vertex insertion into the Lagrangian density. This method, which depends only on power counting, is more direct than previous methods. As a by-product the method leads to as complete a description of the breaking of scale invariance as can be obtained using formal theory only. (J.F.P.)

1597 (JINR-P2-5304) EXPANSION OF THE INVARIANT "TWO-POINT" FUNCTION FOR THE BILOCAL FIELD OF THE LORENTZ, POINCARE AND 0(4,1) (0(3,2)) GROUPS. Blokhintsev, D. I.; Zaikov, R. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1970. 20p. (In Russian). Dep. NTIS (U. S. Sales Only).

The "two-point" function for the bilocal field was expanded in the unitary representations of the Lorentz, Poincare and 0(4,1) (0(3,2)) groups. This expansion was performed in the functions given on the two-sheet, one-sheet hyperboloid or on the cone, respectively. In this way the expansion was obtained for the invariant scattering amplitude of two scalar particles out of the mass surface. (auth)

1598 (NP-18473) NONLINEAR EFFECTS IN QUANTUM ELECTRODYNAMICS. Note No. 273. Costantini, V.; Pistoni, G. (Rome Univ. (Italy). Istituto di Fisica); De Tollis, B. (Rome Univ. (Italy). Istituto di Fisica. Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 12 Jun 1970. 102p. Dep. NTIS (U. S. Sales Only).

The fourth-rank vacuum polarization tensor, which is related to the lowest-order nonlinear interaction between four electromagnetic fields in quantum electrodynamics, is exactly calculated in terms of rational, logarithm and dilogarithm functions when two of the four electromagnetic fields describe photons off the mass shell. This task was accomplished by a not exceedingly laborious effort with the aid of double dispersion relations which proved to be a very convenient tool for the treatment of such problems (in particular, photon-photon scattering). From the explicit expression of the polarization tensor the exact amplitudes for photon-photon scattering, photon splitting and photon coalescence into photons on nuclei were easily obtained. Moreover, the real and imaginary part of Delbrück scattering is given in the form of threefold integrals over the momentum transferred to the nucleus by one of the two virtual photons. This can be compared with the fivefold and sixfold integrals for the imaginary and real part, respectively, available in the existing literature on Delbrück scattering. Finally an explicit expression for the differential cross section of Delbrück scattering in the limit of low energies is given. (auth)

1599 (NYO-3829-55) RENORMALIZATION, DIAGRAMS AND GAUGE INVARIANCE. Bialynicki-Birula, I. (Pittsburgh Univ., Pa. Dept. of Physics. Warsaw Univ. (Poland). Inst. for Theoretical Physics). Aug 1970. Contract AT(30-1)-3829. 36p. Dep. NTIS.

A compact formula for the renormalized transition probability in quantum electrodynamics is derived and its interpretation in terms of the diagrams is given. This formula is used next to prove the equivalence of the Coulomb gauge and the Feynman gauge. It is shown that, contrary to the widespread belief, the problem of the gauge invariance becomes a very delicate one when the radiative corrections are included. The common practice of dropping k_μ and k_ν terms in the photon propagator $D_{\mu\nu}(k)$ is justified, but the justification requires a nontrivial analysis of the gauge transformations of the propagators involved. (auth)

1600 SCATTERING AMPLITUDES IN QUANTUM ELECTRODYNAMICS AT INFINITE ENERGY, AND POSSIBLE IMPLICATIONS FOR HADRON PHYSICS. Chang, Shau-jin; Fishbane, Paul M. (Univ. of Illinois, Urbana). Phys. Rev., D; 2: 1104-22(15 Sep 1970).

The scattering amplitudes at infinite energy due to multiphoton exchange, with interactions among the exchange photons are studied in pure quantum electrodynamics. Such processes, elastic or inelastic, lead to logarithmic dependence on s. The lns dependence is found to be associated with the invariance of subgraphs under a boost along the direction of the high-energy collision. Theoretically, the results lead towards a more efficient way of handling a large class of diagrams, and a better understanding of j-plane cut behavior. It is speculated that several features of our results generalize to hadron physics. Among these are features in common with the limiting fragmentation hypothesis, and the appearance of pionization in a many-fireball structure. Finally, in the absence of radiative corrections, it is demonstrated that the e^-, e^+ elastic scattering amplitude can be expressed as an eikonal form, with $\chi(b)$ being generated by the sum of all connected pieces. (auth)

1601 CREATION AND ANNIHILATION OPERATORS IN FOCK SPACE. Marx, E. (Drexel Univ., Philadelphia). Physica; 48: 247-53(25 Aug 1970).

A discussion is presented of creation and annihilation operators in Fock space, without reference to occupation-number space. This leads to anticommutation relations for fermion operators and commutation relations for boson operators in a more transparent way. (auth)

1602 NONCOMMUTATION REQUIREMENTS AND FIELD DEPENDENCE OF SOURCES OF TENSOR FIELDS. Raman, K. (Brown Univ., Providence). J. Math. Phys. (N. Y.); 11: 2935-8(Oct 1970). (NYO-2262TA-214).

Starting with the noncommutation requirements among different components of a conserved source tensor for a massive spin-2 field, the resulting noncommutation requirements between the source and the field variables, and the field dependence of the source that this necessitates are discussed. (auth)

1603 AXIOMATIC FORMULATION OF THE THEORY OF COINCIDING SIMPLE POLES AND MULTIPLE POLES. Nakanishi, Noboru (Brookhaven National Lab., Upton, N. Y.). J. Math. Phys. (N. Y.); 11: 2970-82(Oct 1970).

In the Bethe-Salpeter formalism, the scattering Green's function is known to have multipole poles synthesized out of coinciding simple poles. An axiomatic approach to the problem of finding the residues of the multiple poles in terms of those of M coinciding simple poles is proposed. The latter residues are regarded as finite-dimensional, mutally orthogonal projection operators on a reflexive Banach space and its dual. Then various properties of the residues of the multiple poles are derived without recourse to the original Bethe-Salpeter equation, and especially it is shown mathematically that they can be decomposed into a direct sum of operators which commute with the Bethe-Salpeter operator. The residues of multiple poles are explicitly determined in two particular cases, M = N + 1 and M = 2, where N denotes the highest order of the singularities (in a parameter) of the residues of the coinciding simple poles. (auth)

1604 REDUCTION OF RELATIVISTIC WAVE FUNCTION FOR ZERO-MASS SYSTEMS. Rajput, B. S. (Kurukshetra Univ., India). Indian J. Pure Appl. Phys.: 7: 720-3(Nov 1969).

The reduction of a relativistic wave function, which transforms as a complex scalar field to the irreducible representation of proper, orthochronous, inhomogeneous Lorentz group, was discussed for a zero-mass system. The effects of the reality condition on the wave function, canonical formalism and second quantizations were also discussed by giving the proofs of the essential theorems. The constants of the expansion of wave function were calculated. (auth)

1605 REGGEIZATION OF THE SPINOR IN YANG–MILLS THEORY. Abers, Ernest (Univ. of California, Los Angeles); Keller, Robert A.; Teplitz, Vigdor L. Contract AT(30-1)-2098. Phys. Rev., D; 2: 1757-9(15 Oct 1970).

The second-order part of the calculations of Gell–Mann et al. (on Reggeization of a spinor interacting with a massive, neutral vector meson) to the case of a massive, isovector vector meson interacting with the conserved vector current is described. It is found that, in second order, the $I = 1/2$ spinor remains a Regge pole, and that no isotopic spin-$3/2$ trajectory appears at the nonsense point. The application of the Mandelstam counting procedure is also discussed. (auth)

1606 IMPROVEMENT OF THE BLANKENBECLER–SUGAR APPROXIMATION. Cohen, Harold (California State Coll., Los Angeles). Phys. Rev., D; 2: 1738-41(15 Oct 1970).

An approximate solution to the Bethe-Salpeter equation is presented. It retains the attractive features of the Blankenbecler-Sugar approximation, while improving upon their results. For one-particle-exchange interactions, there is no increase in calculational difficulty with this technique. (auth)

1607 IDENTITY FOR THE WAVE-FUNCTION RENORMALIZATION CONSTANT. Bernstein, Herbert J.; Salz, E. (Southeastern Massachusetts Univ., North Dartmouth). Phys. Rev., D; 2: 1575-6(15 Oct 1970).

An identity for the wave-function renormalization constant Z, known to work in quantum mechanics, is generalized to field theory. The result is $\partial m/\partial m_0 = Z(1 + \partial\Sigma/\partial m_0)$, where m and m_0 are the physical and bare masses, respectively, and Σ is the self-energy correction to the fermion propagator. Since $Z = 0$ for a composite particle, it follows that a necessary condition for compositeness is $\partial m/\partial m_0 = 0$. (auth)

1608 SPIN–TWO MESONS, THE STRESS TENSOR, AND A FIELD–SOURCE IDENTITY. I. Raman, K. (Brown Univ., Providence). Phys. Rev., D; 2: 1577-85(15 Oct 1970). (NYO–2262TA-204).

It is suggested that the hypothesis that the matrix elements of the stress tensor are dominated by the neutral isoscalar spin-two mesons may be expressed by a field-source identity. This states that, to the lowest order in the gravitational constant κ, the traceless part of the complete stress-energy tensor is proportional to a linear combination of the renormalized field operators of the neutral, isoscalar spin-two mesons. It is shown how this identity may be realized in a Lagrangian field theory, in a manner analogous to the work of Kroll, Lee, and Zumino for the vector-meson dominance of the electromagnetic current. The conditions imposed by Lorentz covariance are discussed. The field-source determines the parts of the singular terms in the stress-tensor commutation relations which are the most singular in the coupling strength. (auth)

1609 BROKEN SCALE INVARIANCE IN SCALAR FIELD THEORY. Callan, Curtis G. Jr. (California Inst. of Tech., Pasadena, Inst. for Advanced Study, Princeton, N. J.). Contracts AT(11-1)-68; AFOSR 70-1866. Phys. Rev., D; 2: 1541-7 15 Oct 1970).

Scalar-field perturbation theory is used as a laboratory to study broken scale invariance. Particular attention is paid to scaling laws (Ward identities for the scale current) and it is found that they have unusual anomalies whose presence might have been guessed from renormalization-group arguments. The scaling laws also appear to provide a relatively simple way of computing the renormalized amplitudes of the theory, which sidesteps the overlapping-divergence problem. (auth)

1610 STRICTLY LOCALIZABLE FIELD THEORIES WITH RISING TRAJECTORIES. Grodsky, I. T. (Cleveland State Univ.). Phys. Rev., D; 2: 1548-53(15 Oct 1970).

The use of the vehicle of perturbative strictly localizable field theory in examining generalized dual-resonance models is investigated with a view towards finding a class of examples rich enough to provide a Born-like input to an order-by-order Reggeized viable unitarization scheme. Although a field-theoretic Lagrangian capable of reproducing the original dual-resonance model as a tree approximation is constructed, it is found that this approach is often misleading, and the pitfalls are explicated. A brief polemic is given to indicate the possibility of obtaining a disease-free tree approximation, and thereby making a step towards a realistic unitary theory of hadronic interaction. (auth)

1611 RENORMALIZATION CONSTANTS, WAVE FUNCTIONS, AND ENERGY SHIFTS IN THE COULOMB AND LORENTZ GAUGES. Haller, Kurt (Univ. of Connecticut, Storrs); Landovitz, Leon F. Phys. Rev., D; 2: 1498-1510(15 Oct 1970).

The scattering wave functions for quantum electrodynamics are examined in the Coulomb gage, in the conventional Lorentz gage, and in a reformulated version of the Lorentz gage. It is shown that when the Lorentz gage is formulated so that Maxwell's equations hold even when the Green's-function pole is displaced off the real axis, Z_3 is identical in the Coulomb gage and in the Lorentz gage. It is also shown that the unrenormalized asymptotic states in the reformed Lorentz gage include a partial dressing of the bare electrons by longitudinal and timelike photons sufficient to generate the electron's static electric field. It is proven that for true bound states the radiative energy shifts in the reformulated Lorentz gage and in the conventional formulation agree. (auth)

1612 FOURTH-ORDER CALCULATION OF THE DIVERGENT PART OF Z_3 IN SPIN-ZERO ELECTRODYNAMICS. Kim, Ick-joh; Hagen, C. R. (Univ. of Rochester, N. Y.). Phys. Rev., D; 2: 1511-18(15 Oct 1970).

As part of the program to determine whether it is possible to have a completely finite theory of quantum electrodynamics, the divergent part of Z_3 is calculated to fourth order in the bare charge e_0 for the case of a charged spinless boson. The wave-function renormalization constant Z_2 is found to be finite in the Yennie gage to lowest order, rather than the Landau gage as in the spinor electrodynamics. (auth)

1613 S MATRIX FOR THE YANG–MILLS FIELD IN A NONLINEAR GAUGE. Maheshwari, Amar (Tokyo Univ.). Phys. Rev., D; 2: 1436-7(15 Oct 1970).

A simple explanation for the modification of the Feynman rules in the field theory of non-Abelian gage fields is found, and it is shown that in suitably defined nonlinear gages the Feynman path-integral method of constructing the generating functional for electrodynamics also yields the correct generating functional for non-Abelian gage fields. (auth)

1614 OPERATOR-PRODUCT EXPANSIONS AND ANOMALOUS DIMENSIONS IN THE THIRRING MODEL. Wilson, Kenneth G. (Stanford Univ., Calif. Cornell Univ., Ithaca, N. y.). Phys. Rev., D; 2: 1473-7(15 Oct 1970).

An example of an operator-product expansion is worked out for the Thirring model. The Thirring model involves a two-dimensional zero-mass Dirac field ψ interacting via the Fermi interaction. The model is scale invariant but the dimensions of local fields in the model vary with the coupling λ. It is shown that ψ has dimension $1/2 + (\lambda^2/4\pi^2)^{-1}$, while the composite fields $\bar{\psi}\psi$ and $\bar{\psi}\gamma_0\psi$, appropriately defined, have the dimension $(1 - \lambda/2\pi)(1 - \lambda/2\pi)^{-1}$. (auth)

1615 ANOMALOUS DIMENSIONS AND THE BREAKDOWN OF SCALE INVARIANCE IN PERTURBATION THEORY. Wilson, Kenneth G. (Stanford Univ., Calif. Cornell Univ., Ithaca, N. Y.). Phys. Rev., D; 2: 1478-93(15 Oct 1970).

Canonical field theory predicts that a zero-mass scalar field theory with a $\lambda\phi^4$ interaction is scale invariant. It is shown here that the renormalized perturbation expansion of the $\lambda\phi^4$ theory is not scale invariant in order λ^2. Matrix elements of the divergence of the dilation current $D_\mu(x)$ are computed in order λ^2 using Ward identities; it is found that $\nabla^\mu D_\mu(x)$ is proportional to $\lambda^2\phi^4(x)$. It is also shown that the dimension of the field ϕ^4 differs from the canonical value in order λ, and that this result leads one to expect a $\lambda^2\phi^4$ term in $\nabla^\mu D_\mu$. It is also found that matrix elements of the composite field $\phi^4(x)$ in perturbation theory have troublesome singularities at short distances which force one to give careful definitions for equal-time commutators and Fourier transforms of T products in the Ward identities involving this field. (auth)

1616 MATHEMATICAL DESCRIPTION OF QUANTIZED FIELDS. Ascoli, R.; Epifanio, G.; Restivo, A. (Univ., Palermo, Italy). Commun. Math. Phys.: 18: 291-300(1970).

The description is started from Haag's proposal to describe quantum fields at a point, corresponding to the heuristic description by means of their matrix elements $(A(\chi)\Phi|\Psi)$ between vectors of a dense linear manifold D of the Hilbert space. This idea is particularized so that the sesquilinear functional that describes the field at a point may be considered as an element of the sequential completion of a space of operators, endowed with a suitable "D-weak" topology. It is shown that any Wightman field may be described in this way, as a rather elementary consequence of the existence of a translation invariant cyclic vacuum. Furthermore the field turns out to be an infinitely differentiable function of space and time. (auth)

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1617 ULTRALOCAL SCALAR FIELD MODELS. Klauder, John R. (Bell Telephone Labs., Inc., Murray Hill, N. J.). Commun. Math. Phys.; 18: 307-18(1970).

The quantum theory of ultralocal scalar fields is developed. Such fields are distinguished by the independent temporal development of the field at each spacial point. Although the classical theories fit into the canonical framework, this is not the case for the quantum theories (with the exception of the free field). Explicit operator constructions are given for the field and the Hamiltonian as well as several other operators, and the calculation of the truncated vacuum expectation values is reduced to an associated single degree of freedom calculation. It is shown that construction of the Hamiltonian from the field, as well as the transition from the interacting to the noninteracting theories, entails various infinite renormalizations which are made explicit. (auth)

1618 MEASUREMENT OF THE LAMB SHIFT IN THE n = 2 STATE OF $^{12}C^{5+}$. Leventhal, M.; Murnick, D. E. (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Lett.; 25: 1237-40 (2 Nov 1970).

A beam of hydrogenic $^{12}C^{5+}$ atoms in the metastable 2S state was produced. By quenching the state in a known motional electric field and measuring the decay length, an indirect measure of the Lamb shift S is obtained. A preliminary result of S = 744 GHz, with a statistical uncertainty of less than 1%, is reported as compared with a theoretical prediction of S = 783 GHz. Possible systematic effects which may reduce the discrepancy are considered. (auth)

1619 REDUCTION OF THE BETHE-SALPETER EQUATION FOR TIME-INDEPENDENT POTENTIALS. Treacy, P. B. (Australian National Univ., Canberra. Univ., Copenhagen). Nucl. Phys.; B21: 486-92(1970).

For potentials independent of the relative time, the Bethe-Salpeter equation reduces in coordinate space to a separable form. Physical boundary conditions are defined and some solutions given for a central potential. For a ladder-type potential, scattering phase shifts and angular-momentum pole trajectories are obtained by numerical methods. (auth)

1620 CLASSICAL FIELD THEORY FOR THE INNER STRUCTURE OF ELECTRONS. Kasper, Erwin (Univ., Tuebingen, Ger.). Z. Naturforsch.; 25a: 985-92(Jul 1970). (In German).

A theory is given which permits a connection between an inner structure of an electron and the motion of its center of mass obeying Dirac's equation. In order to describe inner properties of the particle a classical nonlinear spinor equation is derived from a Lagrangian. There exist rotational symmetric solutions which are simultaneously finite, stationary, normalizable and strongly localized, and which yield the mass at rest, the spin and the magnetic moment of the particle in a correct manner. Since these solutions are in contradiction to Heisenberg's uncertainty principle the calculated properties cannot be directly observed in the laboratory system. Therefore an eight-dimensional configuration space is introduced containing the laboratory system and the center-of-mass system. In this space the wave equation is formulated as a nonlinear differential equation for a spin tensor of second order. If the interaction with an external electromagnetic field is very weak, a separation of this tensor equation into the nonlinear spinor equation mentioned above and into Dirac's equation is possible. Observable quantities in the laboratory system can be obtained by integration over the inner coordinates. (auth)

1621 TENTATIVE PROGRAM FOR THE DEVELOPMENT OF QUANTUM FIELD THEORY AS AN EXTENSION OF THE EQUIVALENCE PRINCIPLE OF GENERAL RELATIVITY THEORY. Klein, O. Nucl. Phys.; B21: 253-60(1970).

An attempt is made towards a generalized quantum field theory based on a formal extension of Einstein's principle of equivalence to electromagnetism and more general interactions between Fermi-fields and Bose-fields. (auth)

1622 IMPLICATIONS OF A PARTIALLY CONSERVED DILATATION CURRENT AND CHIRAL SYMMETRY FOR THE DIMENSIONS OF LENGTH OF LOCAL FIELDS. Dal Cin, Mario (Univ. of Miami, Coral Gables, Fla.). Nucl. Phys.; B21: 108-16(1970).

The hypothesis is exploited that the divergence of a partially conserved dilatation current is a good interpolating field for scalar particles, as proposed by Kastrup and Mack. By means of Ward identity techniques for dilatation and chiral SU(2) × SU(2) transformations, it is shown that dimensions of length can be determined without any use of the canonical formalism. Canonical dimensions of length are obtained if single-particle dominance is assumed. In general the dimensions of length have to obey certain sum rules which involve three-point functions describing strong interactions of $J^P = 0^+$, $I^G = 0^+$ mesons. (auth)

1623 GENERALIZED WARD IDENTITIES AND YANG-MILLS FIELDS. Veltman, M. (CERN, Geneva. Instituut voor Theoretische Fysica, Utrecht). Nucl. Phys.; B21: 288-302(1970).

Ward identities for non-Abelian gauges are derived within the framework of field theory. Subsequently these identities are used to analyze diagrams of the massive Yang-Mills theory to arbitrary order. The detailed results for two-closed loops are given. (auth)

1624 STUDY OF SCALE INVARIANCE IN A BETHE-SALPETER MODEL. Biswas, S. N.; Choudhury, S. Rai; Saxena, R. P. (Univ. of Delhi). Nucl. Phys.; B21: 606-14(1970).

The scale invariance of the electroproduction structure functions $W_1(q^2, \nu)$ and $\nu W_2(q^2, \nu)$ in the limit $q^2 \to \infty$ is studied. The model involves charged scalar particles ϕ, interacting minimally with the electromagnetic field and also with a massless scalar field χ via an interaction of the form $g\,\phi^2\,\chi$. The forward Compton scattering amplitude is then studied in the ladder approximation with the ladder rungs made up of the particles χ. A non-trivial scaling law is obtained for νW_2, but W_1 goes to zero in the limit $q^2 \to \infty$. (auth)

Gravitation and General Relativity

Refer also to abstracts 425 and 838.

1625 (AD-706881) RESEARCH IN QUANTUM FIELDS, PARTICLE THEORY, AND GENERAL RELATIVITY. Final Report. Deser, Stanley (Brandeis Univ., Waltham, Mass. Dept. of Physics). 5 May 1970. 14p. (AFOSR-70-1130-TR). NTIS.

Research under the grant was in two basic areas. In the first, gravitation, three of the principal topics were proof of positive-definiteness of energy and timelike character of the four-momentum for any gravitational system either with normal material sources or source-free. To this end, appropriate covariant methods for decomposing tensors were developed. Unusual properties of solutions of coupled scalar-metric fields were found. A consistent linear Lorentz invariant alternate to general relativity, with self coupling replaced by a nonlocal projection of the conserved part of the matter stress tensor; testable experimental consequences (so far) as in Einstein theory. (auth)

1626 LORENTZ INVARIANCE IN A GRAVITATIONAL FIELD. Kirkwood, Robert L. (Rand Corp., Santa Monica, Calif.). J. Math. Phys. (N. Y.); 11: 2983-9(Oct 1970).

In any theory of gravity in which free particles move along the geodesics of a 4-dimensional metric tensor, a particular class of metrics can be defined which correspond to the fields of Newton's theory of gravity. In these Newtonian fields the metric coefficients which describe intrinsic properties of space and time are clearly separated from those that describe the gravitational field. This separation suggests an invariance in the gravitational field which is quite similar to the usual Lorentz invariance of electromagnetism. The infinitesimal form of the generalized Lorentz transformation is determined by the fact that the 3-dimensional geometry remains Euclidean under the transformation. The finite form is determined so that the transformations form a group, and the group is found to be the usual Lorentz group. The transformation is then applied to fields that are not necessarily Newtonian. (auth)

1627 APPLICATION OF THE ANALOGY REPORT ESTABLISHED BETWEEN MAXWELL ELECTROMAGNETIC THEORY AND EINSTEIN GRAVITATION THEORY. THE VACUUM FIELD EQUATIONS OF THESE TWO THEORIES. Bredimas, Antoine (Paris Univ.). Compt. Rend., Ser. A; 271: 525-8(14 Sep 1970). (In French).

An analogy report between Maxwell electromagnetic theory and Einstein gravitation theory, and the correspondence α that it determines have already been established. It is shown that for a metric $\rho_{\mu\gamma}$, analytical in r^{-1} (r being a definite distance parameter), the first order principal vacuum equations and some of the second order principal equations, in gravitation theory, are the picture by α of the corresponding principal vacuum equations in Maxwell electromagnetism theory. (Saclay)

1628 UNIFORMLY ACCELERATING CHARGED MASS IN GENERAL RELATIVITY. Kinnersley, William; Walker, Martin (Univ. of Texas, Austin). Phys. Rev., D; 2: 1359-70(15 Oct 1970).

A type-{22} solution of the Einstein-Maxwell equations which represents the field of a uniformly accelerating charged point mass is discussed. It contains three arbitrary parameters m, e, and A, representing mass, charge, and acceleration, respectively. The solution is a direct generalization of the Reissner-Nordstrom solution of general relativity and the Born solution of classical electrodynamics. The external "mechanical" force necessary to

produce the acceleration appears in the form of a timelike nodal two-surface extending from the particle's world line to infinity. This does not prevent us from regarding the solution as asymptotically flat and calculating the radiation pattern of its electromagnetic and gravitational waves. A maximal analytic extension of the solution and its properties are discussed. Except for an extra "outer" Killing horizon due to the accelerated motion, the horizon structure closely resembles the Reissner–Nordstrom case. (auth)

1629 ELECTRODYNAMICAL PROPERTIES OF EMPTY SPACE IN GENERAL RELATIVITY. Occhionero, Franco (Goddard Space Flight Center, New York). Phys. Rev., D; 2: 1426-8 (15 Oct 1970).

The general-relativistic formulation of the unipolar induction problem (massive, magnetized, rotating conductor) shows that the external vacuum solution attributes a virtual charge density and a virtual toroidal current to the surrounding empty space. The explanation thereof illuminates a new aspect of the rotational dragging of the inertial frame. If direct consequences of these phenomena could be detected in pulsars or in other astrophysical structures where relativistic gravitation is important, new important verifications of general relativity would be achieved. The main thrust of these considerations lies, however, in their applicability to any rotating metric with a superposed magnetic field. (auth)

1630 DERIVATION OF THE EQUATIONS OF MOTION OF A GYROSCOPE FROM THE QUANTUM THEORY OF GRAVITATION. Barker, B. M. (Louisiana State Univ., Baton Rouge); O'Connell, R. F. Phys. Rev., D; 2: 1428-35(15 Oct 1970).

Previous work on the gravitational two-body problem is surveyed. Next, a new approach is presented which is considered to be simpler and more transparent than the usual methods because it is based on a gravitational potential energy. This enables the calculations to be carried out using only the familiar tools of Newtonian mechanics and the Euler–Lagrange equations. Starting from a gravitational potential energy derived from Gupta's quantum theory of gravitation, the classical motion of a spherical gyroscope in the gravitational field of a much larger mass with a quadrupole moment is found. The results of the precession of the spin are compared with those of Schiff, and a detailed derivation of the results of O'Connell for the effect of a quadrupole moment (and higher moments) on the precession of the spin is presented. In addition, some new results are presented. First, it is shown that the quadrupole moment manifests its presence in another way, which also contributes to the precession of the gyroscope a term that is about ten times larger than what could be detected. Second, with regard to the precession of the orbit, in addition to the usual contributions, the results include the effects of the spin of both particles (which enables the effect of the rotation of Mercury on the precession of its perihelion to be calculated). (auth)

1631 UNIQUENESS OF THE RESPONSE TO THE VARIATION OF AN EXTERNAL GRAVITATIONAL FIELD. Katzin, J. C.; Rolnick, William R. (Wayne State Univ., Detroit). Phys. Rev., D; 2: 1410-16(15 Oct 1970).

The response of operators of a quantum field theory to variations of the metric tensor is investigated. A class of operators, defined in a previous publication, is shown to include all physically relevant fields and currents. The response of such objects to variations of $g_{\mu\nu}$ is found and shown to be unique. The commutators $[T^{\mu\nu}(x),A(x')]$, where A is any such operator, are discussed. For $\mu = 0$ (or $\nu = 0$), these commutators are displayed and depend only upon the tensor structure of A and its equation of motion. However, for $\mu,\nu = i,j$ it is found that the time derivative of the varied quantity appears in the field equations, for which the usual derivation of equal-time commutators is incomplete. (auth)

1632 MACHIAN THEORY OF INERTIA AND GRAVITATION. Gilman, Robert . (Princeton Univ. Observatory, N. J.). Phys. Rev., D; 2: 1400-10(15 Oct 1970).

The generally covariant integral formulation of Einstein's field equations developed by Sciama, Waylen, and the author is used to define the source-free contribution to the inertial-gravitational field. A theory is then developed, based on Mach's ideas on the origins of inertia, that requires of acceptable cosmological models that they be entirely source-generated solutions of Einstein's field equations without the cosmological constant term. It is then shown that many (and probably all) nonempty relativistic Robertson–Walker models with $\Lambda = 0$ and $0 \leq p \leq \rho c^2$ are acceptable Machian cosmologies, in terms of this theory. On the other hand, many solutions are found to be unacceptable as Machian cosmologies, including the Minkowski, Schwarzchild, Kerr, Gödel, and Kantowski–Sachs–Thorne solutions. Some of the implications of this theory are discussed. (auth)

1633 CONSERVATION OF MATTER IN GENERAL RELATIVITY. Hawking, Stephen (Inst. of Theoretical Astronomy, Cambridge, Eng.). Commun. Math. Phys.; 18: 301-6(1970).

It is shown that in classical general relativity, if space-time is nonempty at one time, it will be nonempty at all times provided that the energy momentum tensor of the matter satisfies a physically reasonable condition. The apparent contradiction with the quantum predictions for the creation and annihilation of matter particles by gravitons is discussed and is shown to arise from the lack of a good energy momentum operator for the matter in an unquantized curved space-time metric. (auth)

1634 SOLUTION OF CONNECTION EQUATIONS IN THE ANTISYMMETRIC CASE OF THE HYPERCOMPLEX UNITARY THEORY. APPLICATION TO A VARIATIONAL PRINCIPLE. Clerc, Rene-Louis (Univ., Toulouse). Ann. Inst. Henri Poincare, Sect. A; 12: 343-64(1970). (In French).

The hyperbolic complex theory was used to solve the classical connection equations of Einstein–Schroedinger when the fundamental tensor of the ordinary manifold V_4 (four-dimensional space-time) is antisymmetric. This tensor is here locally determined by a four-vector of V_4 thanks to which a particular symmetric connection of the manifold satisfying the equations studied was obtained. Using the results of this solution, a variational principle was written, the only independent variables used being the antisymmetric components $k^{\alpha\beta}$; from that the field equations of the antisymmetric case were deduced. A great number of simplifications essentially related to the symmetric and antisymmetric properties of the different elements used, led to elementary relations and the symplectic character of the manifold permitted one to conclude that a scalar characteristic of the theory was invariant. (France)

1635 GRAVITATIONAL RADIATION FROM A BOUNDED SOURCE. II. Madore, J. (Univ., Paris). Ann. Inst. Henri Poincare, Sect. A; 12: 365-92(1970). (In French).

A comparison was made between the coefficients of $1/r$ in the asymptotic expansion of the components of the metric tensor in a harmonic coordinate system and in a null coordinate system (a coordinate system adapted to a family of forward null hypersurfaces). It was found that the comparison is most simply made if one takes as null coordinate system a radiative coordinate system of the type introduced by Papapetrou. (France)

1636 SURFACE LAYERS WITH CYLINDRIC SYMMETRY IN GENERAL RELATIVITY. Langer, J. (Univ., Paris). Ann. Inst. Henri Poincare, Sect. A; 12: 393-413(1970). (In French).

The problem of joining two cylindrically symmetric metrics on a timelike hypersurface was solved. It was shown that if both metrics are static the hypersurface cannot represent the motion of a physically admissible surface layer except in the special case of a surface layer consisting of an ideal gas of particles with zero proper mass. Finally the hypersurface representing a surface layer in an oscillatory motion was constructed. This hypersurface divides space-time in two regions; in the first one, which contains the axis of cylindric symmetry, the metric is nonstatic; in the other one it is static. (France)

1637 NULL ELECTROMAGNETIC FIELDS IN GENERAL RELATIVITY. Banerjee, A. (Jadavpur Univ., Calcutta). J. Phys., A (London); 3: 501-4(Sep 1970).

A class of solutions of the Einstein–Maxwell equations corresponding to stationary null electromagnetic fields in otherwise empty space is presented. (auth) (UK)

1638 CHRONOMETRICALLY INVARIANT REPRESENTATION OF CLASSIFICATIONS OF PETROV'S GRAVITATIONAL FIELDS. Grigor'eva, L. B. Dokl. Akad. Nauk SSSR; 192: 1251-4(21 Jun 1970). (In Russian).

The chronometrically invariant formulation of the algebraic classifications of Petrov's gravitational fields was studied in order to derive their physical interpretation for a given frame of reference, and to determine the chronometrically invariant conditions with respect to a fixed four-dimensional space-time point in the general theory relativity. Conditions were defined to reach a references system which moves on the acceleration without deformation with respect to the local geodetic coordinate system. Coincidence of the imaginary portions of curvatures revealed the presence of matter, presenting an additional contribution to the real portion of the stationary curvature. (TTT)

Scattering Theory

Refer also to abstracts 1594, 1597, and 1619.

1639 (AD-705548) FURTHER REMARKS ON THE HIGH-ENERGY BEHAVIOR OF RESONANCE POLES IN THE COMPLEX PLANE. Paciello, M. L.; Sertorio, L.; Taglienti, B. (Rome Univ. (Italy). Istituto di Fisica). 12 Jan 1970. Contract F61052-67-C-0084. 32p. (NI-250; AFOSR-70-1233-TR). NTIS.

By use of a model unitarity dynamical scheme, various possible

energy behaviors of the resonance widths at high energy are analyzed. Correspondingly Re alpha (s) is calculated. Moreover in the model it is also found that a linear trajectory may only result in the limit of vanishing pion mass. (auth)

1640 (IFVE-STF-69-106) FAST PARTICLE SCATTERING ON COULOMB AND SHORT RANGE POTENTIALS. Savrin, V. I. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1969. 19p. (In Russian). Dep. NTIS (U. S. Sales Only).

The scattering of fast particles on the potential, which is a sum of Coulomb and short range potentials, is considered. The expressions for the scattering amplitude at small and large angles and Bethe's interferential formula were obtained. (auth)

1641 (LYCEN-7046) THEORETICAL ANGULAR DISTRIBUTIONS AND POLARIZATIONS IN THE THREE-BODY PROBLEM. Fayard, C.; Lamot, G. H.; El Baz, E.; Pigeon, J.; Barguil, J.; Joseph, J. (Lyon Univ. (France). Institut de Physique Nucleaire). Jul 1970. 29p. Dep. NTIS (U. S. Sales Only).

The aim was to determine the angular distribution or the polarization of the emerging particle in the three body problem using the Faddeev equations. A simplification is obtained if nonlocal separable potentials are used and thus the Faddeev–Lovelace formalism seems more adequate. A complete angular momentum reduction of the Faddeev–Lovelace equations based on the procedure described by Stingl and Finat is given and the angular distribution and the polarization of the emerging particles are derived. The special cases usually described are shown to be easily obtained. For example, the result for (neutron, deuteron) three body elastic scattering is given. (France)

1642 ANALOG MODEL FOR KSV THEORY. Fairlie, D. B. (Univ. of Durham, Eng.); Nielsen, H. B. Nucl. Phys.; B20: 637-51(1970).

An analog model based upon the association of amplitudes for many particle processes with functional integrals over interaction regions of the exponential of the energy of momentum flow is shown to yield in first approximation the multiparticle Veneziano representation. The correction terms in the next approximation are shown to be just those given by the planar loop amplitude in the theory of Kikkawa, Sakita and Virasoro. This approach casts new light upon the divergence problem of the loop amplitudes in a dual theory but it does not provide, as yet, an unambiguous answer to it. (auth)

1643 POLES OF THE SCATTERING OPERATOR FOR THE SCHROEDINGER EQUATION. Steinberg, Stanly (Purdue Univ., Lafayette, Ind.). Arch. Ration. Mech. Anal.; 38: 278-89(1970).

Two fundamental propositions concerning the poles of the scattering operator for the Schroedinger equation are discussed. The scattering operator is studied from the stationary point of view; that is, the integral operator $T(\chi)$, where χ is the energy parameter, is introduced which depends analytically on χ. The scattering operator is then defined in terms of $T(\chi)$. The first proposition is that in most circumstances the poles of the scattering operator and the poles of $(I - T(\chi))^{-1}$ occur at the same points. The second proposition is that the poles of the scattering operator in the upper half of the χ plane (bound-state poles) are of first order. The only restriction on the potential is that it decays exponentially at infinity. This allows discussion of asymmetric Yukawa potentials. (J.F.P.)

1644 INTEGRAL TRANSFORMATIONS IN MOMENTUM SPACE AND CONFORMAL INVARIANCE. Castell, L. (Max-Planck Institut fuer Physik und Astrophysik, Munich). J. Math. Phys. (N. Y.); 11: 2999-3001(Oct 1970).

A certain element Z of the identity component of the conformal group together with the Poincaré subgroup generate the whole conformal group. In order to prove the conformal invariance of an S-matrix, only the invariance under Z has to be checked, once relativistic invariance is established. The explicit form of Z for certain physically important representations of the different covering groups of the conformal group will be derived. The transformation Z turns out to be an integral transformation. (auth)

1645 RELATIVE POSITION REPRESENTATION FOR A RELATIVISTIC TWO-PARTICLE SYSTEM. McDonald, S. C. (Ames Lab., Iowa). J. Math. Phys. (N. Y.); 11: 3001-8(Oct 1970).

Two-particle angular momentum states are constructed which are localized with respect to the magnitude of the relative position in the rest system and which have arbitrary 3-momentum dependence. The associated relative position operator is constructed, and a quantum-mechanical analog of the classical impact parameter is identified. Two-particle angular momentum states are constructed, which are also localized with respect to the "mean-position" of the 2-particle system, and the associated "mean-position" operator is seen to be a generalization of the 1-particle Newton–Wigner position operator. (auth)

1646 EXTENSION OF THE RIEMANN–LEBESGUE LEMMA. Kantor, Paul B. (Case Western Reserve Univ., Cleveland). Contract AT(11-1)-1753. J. Math. Phys. (N. Y.); 11: 3099-3103(Oct 1970).

It is shown that in the limit of large λ, integrals of the form $H(\lambda) \equiv \int_a^b [f(x)\,dx/u(x) + e^{i\lambda x}]$ are essentially given by $\int_{R'} [f(x)/u(x)]dx$ where the region R' is the union of all those subintervals in which $|u| \geq 1$. The corrections to this expression are of two kinds: terms $O(1/\lambda)$ which depend on the details of averaging to remove logarithmic singularities in $H(\lambda)$ and terms $O[(\ln\lambda)/\lambda]$. Some examples are given. If $|u| \leq 1$, the leading term in H vanishes and $H(\lambda)$ is bounded by $(\ln \lambda)/\lambda$. (auth)

1647 REAL AND SPURIOUS STATES IN THE DUAL-RESONANCE MODEL. Gliozzi, F. (Istituto Nazionale di Fisica Nucleare, Turin). Nuovo Cim.; 70A: 90-102(1 Nov 1970).

A selection rule that forbids transitions between real and spurious states in the dual-resonance model is fully exploited to obtain in a closed form the projector on the real states which contribute to a given pole of a dual amplitude. More general selection rules are exhibited which suggest that spurious states could describe some sort of charged particles. (auth)

1648 RELATIVISTIC POTENTIAL SCATTERING AND FIELD-THEORETICAL AMPLITUDE. Lardera, S.; Montaldi, E.; Prosperi, G. M. (Univ., Milan. Istituto Nazionale di Fisica Nucleare, Milan). Nuovo Cim.; 70A: 103-18(1 Nov 1970).

The relativistic direct-interaction formalism is compared with a simple model of a field theory. It is shown that, if one neglects the retardation effects for the exchanged particles, the elastic field-theoretical amplitude off the energy shell in the ladder approximation can be identified with the corresponding quantity for an appropriate direct interaction which is a straight generalization of the Yukawa potential. It is then shown that, on shell and at least in the lower orders in perturbation theory, also the retardation effects can be taken into account, and the procedure generalized to the complete elastic amplitude, provided that one includes appropriate additional terms in the "potential." (auth)

1649 USE OF THE DIFFERENTIAL EQUATION METHOD TO STUDY NONRELATIVISTIC FEYNMAN AMPLITUDES. Giffon, Maurice; Joseph, Jacques; Meyer, Jacques (Lyon Univ.). Compt. Rend., Ser. B; 271: 533-6(14 Sep 1970). (In French).

The function associated with nonrelativistic Feynman diagrams of third order was obtained by using the differential equation method. (Saclay)

1650 FIVE-POINT UNITARIZED VENEZIANO FORMULA. Riordan, F. (Univ. of Birmingham, Eng.). Nuovo Cim.; 70A: 44-56(1 Nov 1970).

An equation gives a five-point production amplitude with two- and three-particle cuts extracted. Equating the five-point Veneziano formula to this gives a unitarized version. Solutions near single and double poles are found. (auth)

1651 PARITY TWINS AND THE CARLITZ–KISLINGER MODEL. Lyth, D. H. (CERN, Geneva). Nuovo Cim.; 70A: 31-43(1 Nov 1970).

It is shown that under certain assumptions unitarity demands the presence of parity twins for fermion trajectories, even if there is a fixed J-plane branch cut (Carlitz–Kislinger cut). The parity twin trajectory will not be degenerate with the original one unless the cut is absent, but for strong coupling unitarity makes it approximately degenerate. A modified Carlitz–Kislinger model is written down, which respects unitarity by including the parity twin; in the limit where the twin is degenerate the J-plane cut disappears. (auth)

1652 VARIATIONAL CALCULATION OF THREE-BODY BREAKUP AMPLITUDES. Pieper, S. C. (Univ. of Illinois, Urbana); Wright, Jon; Schlessinger, Leonard. Phys. Rev., D; 2: 1561-75(15 Oct 1970).

A previously reported variational principle is used to compute three-body elastic and breakup scattering amplitudes for positive total energies. The calculation converges quite rapidly and requires very little computer time. The forms of the variational principle suitable for systems where some of the particles are identical bosons are also derived. The examples presented are for Yamaguchi potentials and do not represent any physical system; they were chosen to have large breakup cross sections. The results are presented as Dalitz plots and other graphs which exhibit some interesting features. (auth)

1653 BOOTSTRAP CONDITIONS FROM UNITARITY AT HIGH ENERGY. Finkelstein, Jerome (Stanford Univ., Calif.). Contract AFOSR F44620-68-C-0075. Phys. Rev., D; 2: 1591-5 (15 Oct 1970).

The unitarity relation for the high-energy scattering of two particles is investigated under the assumption that the production amplitudes which enter the unitarity sum are given by a single Regge-pole exchange; the further assumption of multi-Regge exchange is not made. It is seen that the unitarity sum can be expressed as an integral involving the particle-Reggeon scattering amplitude (which may be defined in terms of the six-point function), and by representing this amplitude by Regge exchange, one obtains an equation which leads to self-consistency conditions on the Regge parameters. Solutions to this equation have, in addition to Regge poles, Regge cuts which interfere destructively with the poles. Comparisons are made with related models, in particular, the multi-Regge model. It is suggested that, while Regge cuts calculated by the multi-Regge method are model dependent, the bootstrap condition on the Regge pole is more general. (auth)

1654 MULTIPERIPHERAL INTEGRAL EQUATION FOR FINITE VALUES OF MOMENTUM TRANSFER AND ITS PROPERTIES. Pinsky, Stephen (Weizman Inst. of Science, Rehovoth, Israel); Weisberger, William I. hys. Rev., D; 2: 1640-9(15 Oct 1970).

A multiperipheral integral equation is derived and studied for the absorptive part of the elastic scattering amplitude at high energy and finite spacelike momentum transfer. The equation is constructed from the unitarity relation with the production amplitudes represented by a multi-Regge model with general Toller-angle dependence for the vertex functions. It is shown that there are moving branch cuts and factorizable poles in the J plane which dominate the high-energy asymptotic behavior of the amplitude. The possibility of asymptotically self-consistent solutions is discussed. Explicit formulas are given for calculating the slope of a Regge trajectory at a given momentum transfer from the solution of the integral equation at that point. Approximations to phase space and their relation to the weak-coupling limit are analyzed. (auth)

1655 DIRECT AND CROSSED WATSON TERMS IN THREE-BODY FINAL-STATE INTERACTIONS. Martin, Anna J. (Univ. of Illinois, Urbana). Phys. Rev., D; 2: 1663-8(15 Oct 1970).

Three-body final-state interactions are considered for simple cases within the framework of the Khuri-Treiman equation. It is noted that an approximation to partial-wave amplitudes, which consists essentially of the direct- and crossed-channel Watson terms, reproduces the analytic properties of the exact amplitudes to a considerable extent, particularly in the vicinity of the physical region. (auth)

1656 ASYMPTOTIC BEHAVIOR OF SCATTERING AMPLITUDES IN THE RELATIVISTIC EIKONAL APPROXIMATION. Levy, M.; Sucher, J. (Univ. of Maryland, College Park). Phys. Rev., D; 2: 1716-23(15 Oct 1970).

Using techniques developed in an earlier paper, a new one-parameter eikonal representation is derived and its high-energy behavior is studied. It is shown that by also taking t large, a Regge-like behavior is obtained in the crossed channel. The procedure of first making s large and then t large is investigated more closely by comparing the exact fourth-order amplitudes with those obtained in the relativistic eikonal approximation. It is found that the latter predicts the correct behavior in the region of large s, for all values of t. When a similar procedure is applied to the full $M_{eik}(s,t)$, one obtains in an appropriate domain an asymptotic amplitude having a dual character: The bound states appear as poles in the s channel and lie on the Regge trajectory in the t channel. In particular, for electron–positron scattering the corresponding energy levels coincide with those obtained recently by Brezin et al. The asymptotic behavior of the eikonal function itself is also studied. (auth)

1657 $\pi\pi$S- AND P-WAVE LOW-ENERGY MODELS FROM ANALYTICITY, UNITARITY, AND CROSSING SYMMETRY. Bonnier, B.; Gauron, P. (Institut de Physique Nucleaire, Paris). Nucl. Phys.; B21: 465-85(1970).

Models for the $\pi\pi$S- and P-waves are constructed using elastic unitarity, the known properties of the partial waves discontinuities across the left-hand cut at threshold, and the existence of the ρ-meson. Three sets are found to fulfill rigorous constraints deduced from analyticity, positivity, and crossing symmetry. The main result is that, in each case, the I = 0 phase shift goes through 90°. (auth)

1658 POSSIBLE VENEZIANO AMPLITUDE FOR MANY PIONS. Olive, D. I.; Zakrzewski, W. J. (Cambridge Univ., Eng.). Nucl. Phys.; B21: 303-20(1970).

A possible modified Veneziano amplitude relevant to any even number of pions is developed. The amplitudes possess π- and ρ-trajectory structure with the features that there is no spin-0 particle on the ρ-trajectory, and that appropriate factorization into lower amplitudes occurs at pion poles with the Lovelace 4π amplitude as the basic unit. The leading trajectory spectrum is investigated by looking at the factorization properties of the general amplitude, and it is found that the ρ is at least doubled and that we can accommodate the A_1 only at the expense of spin-2 ghosts on the leading trajectories. In the theory with no A_1 the π- and ρ-trajectories are singly and doubly degenerate respectively. (auth)

1659 BARRIER SCATTERING IN FIELD THEORY REMOVAL OF KLEIN PARADOX. Nikishov, A. I. (Lebedev Inst. of Physics, Moscow). Nucl. Phys.; B21: 346-58(1970).

The Feynman method of the Green function in quantum electrodynamics is modified to treat scattering problems with a one-dimensional potential. The Green function is constructed from the solutions of the Klein–Gordon (Dirac) equation. The absence of a Klein paradox in a field theoretical treatment is demonstrated. Pair production by the one dimensional potential is considered and the Sauter type potential is used to illustrate general results. (auth)

1660 OPERATOR EXPRESSION FOR THE KOBA AND NIELSEN MULTI-VENEZIANO FORMULA AND GAUGE IDENTITIES. Gervais, J. L. (Faculte des Sciences, Orsay, France). Nucl. Phys.; B21: 192-04(1970).

An operator expression is derived for the Koba and Nielsen multi-Veneziano formula. It generalizes the result of Fubini, Gordon and Veneziano. As it is expressed in term of "local fields" which are covariant under homographic transformation, this leads to a simple interpretation of the algebra introduced by Gliozzi and of the gauge identities which are generalized to obtain conditions on the general vertex considered by Sciuto. (auth)

1661 ADLER ZERO CONDITION AND CURRENT ALGEBRA. Ellis, John (Cambridge Univ., Eng.). Nucl. Phys.; B21: 217-41(1970).

The consequences are investigated of applying the Adler zero condition to pseudoscalar meson theories. Lagrangians with SU(2) or octet broken SU(3) symmetry, linearly transforming pseudoscalar mesons, and irreducible amplitudes bilinear in the particle momenta are considered. At the SU(2) level a threefold indeterminacy is found. The Adler condition generates axial currents, but any of the current algebras SU(2) × SU(2), E_3 or SO(3,1) may be realized: also the chiral symmetry breaking is unspecified, and there is an unknown scale. The dynamical hypothesis of dominance by non-exotic channel exchanges is found to favor SU(2) × SU(2) solutions, but the overall scale can only be determined by identifying the currents generated by the Adler condition with the phenomenological weak axial currents. At the SU(3) level models are considered with non-derivative octet SU(3) breaking and an octet of pseudoscalar mesons, with Adler zeroes for pions and kaons. The pseudoscalar mass splitting constrains the form of symmetry breaking, and there is just a two-parameter family of solutions, of which the chiral SU(3) × SU(3) Lagrangian with $(3,3^*)+(3^*,3)$ symmetry breaking is dynamically preferred. Thus current algebra and a number of chirality predictions are implied largely by the Adler zero condition. (auth)

1662 MODEL FOR THE INELASTIC SCATTERING OF A PARTICLE ON A BOUND SYSTEM. Janev, R. K.; Zivanovic, Dj. (Boris Kidric Inst. for Nuclear Sciences, Belgrade). Phys. Lett.; 33A: 127-8(5 Oct 1970).

A simple model is proposed, suggested by an approximation for the generalized one-particle Green function, to describe the scattering of a particle on the bound system of identical particles. The consistency of the model is discussed. (auth)

Particle Accelerators

Refer also to abstracts 404, 416, 420, 1530, 1710, and 1739.

1663 (AD-709682) RADIATION PROTECTION INTERLOCK SYSTEM FOR THE 8-MeV ICT TANDEM ACCELERATOR. Final Report, August 1969–January 1970. Kivett, P.; Breitenbecher, D.; Hennecke, H. J. (Aerospace Research Labs., Wright-Patterson AFB, Ohio). Jun 1970. 44p. (ARL-70-94). NTIS.

A radiation protective system for a tandem accelerator utilizing interlocks, electric door locks and audio-visual warning devices is described. The system consists of four types of units. A master control panel (ACCELERATOR OPERATING CONDITION MONITOR) determines interlock and warning conditions by monitoring accelerator variables. An interlock control panel (INTERLOCK INDICATOR AND CONTROL PANEL) controls access to radiation areas. Warning lights and siren units (so called) present visual and audible indications of radiation conditions and abrupt changes in radiation conditions. Located at each door is a unit (ENTRANCE INTERLOCK INDICATOR UNIT) which is connected to a Micro-Switch and door lock. Responsibility for radiation safety is placed on the person operating the accelerator who is aware of the existing radiation conditions and has control of the access to radiation

areas. Care has been taken in order to make the interlock system as "Fail-safe" and reliable as possible. (auth) (USGRDR)

1664 (BARC–459) VAN DE GRAAFF LABORATORY PROGRESS REPORT. David, T. P. (comp.) (Bhabha Atomic Research Centre, Bombay (India)). 1970. 42p. Dep. CFSTI (U. S. Sales Only).

The operation and utilization of the 5.5 MeV Van de Graaff accelerator at Trombay during the period from July 1, 1968, to Dec. 31, 1969, are summarized. Research and instrumentation development are outlined. (W. H.K.)

1665 (BNL–15174) COMPUTED PROPERTIES OF A TWO-DIMENSIONAL SECTION OF THE 2-IN.-BORE, 40-kG AC DIPOLE. Dahl, P. F.; Morgan, G. H.; Young, Anne (Brookhaven National Lab., Upton, N. Y.). 18 Sep 1970. 9p. Dep. NTIS.

The computed effects of several iron configurations on the stored energy, field quality, superconducting hysteretic loss, and other properties of a proposed 2-in. -bore synchrotron dipole are presented. (auth)

1666 (IYAF-2-70) ON SPIN PARTICLES MOVEMENT IN A STORAGE RING WITH AN ARBITRARY FIELD. Derbenev, Ya. S.; Kondratenko, A. M. (Akademiya Nauk SSSR, Novosibirsk. Institut Yadernoi Fiziki). 1970. 28p. (In Russina). Dep. NTIS (U. S. Sales Only).

The spin movement in the storage rings with arbitrary electromagnetic field is investigated on the condition that the particle's closed orbit does exist. It has been shown that on the closed orbit there is a periodic spin movement as stable as the polarization along the field in the magnetic field with a nearly constant direction. It opens up wide possibilities to control polarization in the storage rings. (auth)

1667 (JINR–P9-5246) MODELING OF THE MAGNETIC SYSTEM OF THE JINR PHASOTRON WITH A SPATIAL FIELD VARIATION. Alenitskii, Yu. G.; Vorozhtsov, S. B.; Zaplatin, N. L.; Lytkin, L. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1970. 23p. (In Russian). Dep. NTIS (U. S. Sales Only).

The results of the model investigation of the magnetic system of the phasotron with a spatial field variation are given. The required field variation is formed. The average field differs from the required one by ±70 Oe. (auth)

1668 (JINR–P9-5312) SOME PROBLEMS OF REALIZATION OF THE ALTERNATING-PHASE FOCUSING PRINCIPLE IN THE ION LINEAR ACCELERATORS. Beznogikh, Yu. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1970. 23p. (In Russian). Dep. NTIS (U. S. Sales Only).

The phase- and the radial stability of particles accelerated in the ion linear accelerators with the alternating-phase focusing is considered. Zero periods of acceleration, in which the synchronous phase is equal to $+\pi/2$ and $-\pi/2$, respectively, are introduced pairwise into the accelerating system with step variation of the synchronous phase ($\phi_s = -\phi_s$). As a result in the structure considered both the radial and the phase stabilities of accelerated particles essentially increase. (auth)

1669 (N–70-33060) NEW APPROACH TO THE SMALL ACCELERATOR VACUUM SYSTEM. Steinberg, Robert; Alger, Donald L. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Jul 1970. 10p. (NASA-TM-X–2052; E–5653). NTIS.

The incorporation of a titanium bulk sublimator in combination with a getter ion pump in a small accelerator vacuum system is shown to provide major advantages in pumping performance, reduction of the tritium hazard, and improvement in system reliability. A mode of operation is suggested for the sublimator which can greatly increase sublimator lifetime. Typical operating data for the vacuum system of a 300 kilovolt accelerator equipped with a sublimator/ion pump combination are presented. A suggestion for the adaptation of a comparable vacuum system to a standard 150 kilovolt accelerator is made. (auth) (STAR)

1670 (NBS-Handbook–107) RADIOLOGICAL SAFETY IN THE DESIGN AND OPERATION OF PARTICLE ACCELERATORS. (American National Standards Inst., New York). Jun 1970. 14p. GPO $0.30.

Recommended safety standards for the design and operation of particle accelerators with primary energies less than 100 MeV are presented. Topics include radiation protection design criteria, operational health physics, radiation measurements, and dose assessment. (W.H.K.)

1671 (RPP/N–18) INTENSITY LIMITATIONS IN NIMROD. Gardner, I. S. K.; Gray, D. A.; Ranft, J.; Rees, G. H.; Wroe, H. (Rutherford High Energy Lab., Chilton (England)). [1968]. 33p. (CONF-681029–3). Dep. NTIS (U. S. Sales Only).

From National Particle Accelerator Conference, Moscow, USSR.

A study is being made of the problems of increasing the accelerated beam intensity of Nimrod, the British 7 GeV constant gradient proton synchrotron. Results of some measurements of the proton beam properties during injection, trapping and acceleration and in some cases a theoretical explanation of these results are presented. The measurements show that, at its current operating intensity of 2×10^{12} protons per pulse, Nimrod is space charge limited using 15 MeV injection as at present. (auth)

1672 (RPP/N–22) EXTRACTION TECHNIQUES AT NIMROD. Gray, D. A.; Harold, M. R.; Morgan, R. H. C.; King, N. M.; O'Connell, M. J. (Rutherford High Energy Lab., Chilton (England)). 13 Aug 1970. 14p. (CONF-700908–3). Dep. NTIS (U. S. Sales Only).

From 2nd National Conference on Particle Accelerators, Moscow, USSR.

The 7 GeV proton synchrotron Nimrod, currently operating at 2.5×10^{12} protons per pulse, has three extracted beamlines. Two of these (X1 and X2) derive from a single extractor magnet, whose current is switched during flat-top to provide a fast spill for X1 and slow spill for X2. The third line (X3) serves the new experimental hall 3 and is fed from a magnet which is situated 90° round the ring from X1. Until June 1970 the achromatic energy-loss extraction method was used for both channels, the extraction efficiency being typically around 30%. Each channel required a plunging quadrupole in addition to its extractor magnet. Since over 80% of the circulating beam is used for extraction purposes, plans were made to test two further methods of extraction with the aim of increasing this efficiency. The first of these methods, called Thin Septum Piccioni, was commissioned in January 1970 and has been in use with the X3 beamline since June 1970. The second, Resonant Extraction, has also been tested but further studies are required for optimisation. The progress made on the two methods is described. (auth)

1673 (UCRL–19823) SOTRM: A PROGRAM TO GENERATE FIRST AND SECOND ORDER MATRIX ELEMENTS BY TRACKING CHARGED PARTICLES IN A SPECIFIED MAGNETIC FIELD. Close, Elon R. (California Univ., Berkeley. Lawrence Radiation Lab.). 12 May 1970. Contract W-7405-eng-48. 48p. Dep. NTIS.

A CDC 6600, FORTRAN IV program SOTRM is described. SOTRM generates first and second order transformation elements by integrating numerically through a specified magnetic field. It can also be used for ray tracing. Data input is described and an illustrative example is presented. The results obtained can be used in a matrix beam transport program. (auth)

1674 (UCRL–20049) EFFECT OF VERTICAL LENS AT RADIAL REGENERATION NODE IN BERKELEY 184-INCH SYNCHROCYCLOTRON. Paul, A. C.; Grunder, H. (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 7p. Dep. NTIS.

An attempt is made to understand and correct the vertical growth in the peeler of the 184-inch cyclotron. It is shown that a vertically focusing quadrupole field with its origin at the radial regeneration node improves the extraction efficiency somewhat, but cannot make all vertical orbits stable. (auth)

1675 (UCRL-Trans–1419) POSSIBILITY OF ACCELERATING POLARIZED PROTONS IN THE RING-O-TRON. Lapidus, L. I.; Plis, Iu. A.; Sarantsev, V. P.; Soroko, L. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). Translated for Univ. of California Lawrence Radiation Lab., Berkeley, from report JINR–P1-5209. 22p. Dep. NTIS.

The electron ring accelerator (ERA) may be very useful for the production of polarized particles of high intensity. It is due to the fact that polarized ions are accumulated in the electron ring during the time of injection (approximately 1 msec). With the atomic beam density $\rho = 2 \cdot 10^{10}$ cm^{-3} and the number of electrons in the ring $N_e = 3 \cdot 10^{13}$ we have the number of polarized protons in the ring $N_i = 2.5 \cdot 10^{11}$, i.e., as in the ordinary mode for nonpolarized ions. The crucial problem is to conserve polarization during the time of injection and acceleration. The estimations for P show that the decrease of the number of electrons is necessary for producing polarized ions with a high polarization degree. Fortunately, the limit is rather high ($N_e \leq 3 \cdot 10^{13}$) for the projected parameters of the compressor. The polarized proton beam after acceleration will have the longitudinal polarization, which can be changed to the transversal polarization, if necessary, with the magnet ($l = 2.7$ m, $B = 10^4$ gauss for any energy). The sign of polarization can be changed every pulse that gives possibilities for sensible experiments on the P, T-parity conservation. Some essential experiments are discussed. (auth)

1676 PULSE PROPERTIES OF LARGE 50–50 NiFe TAPE CORES. Winter, Stuart D.; Kuenning, Robert W.; Berg, Gary G. (Univ. of California, Livermore). IEEE (Inst. Elec. Electron. Eng.). Trans. Magnet.; MAG-6: 41-5(Mar 1970). (UCRL-71514).

Over 400 cores of 1-mil 50–50 NiFe, each core containing 40 or more pounds of material, are used in a linear induction accelerator, which is a part of a controlled thermonuclear research experiment. Each core couples a constant voltage pulse of approximately 10 kV lasting 350 ns to an electron beam whose current is in the hundreds of amperes range. To achieve reasonable operation of the accelerator it is essential that the drive power to the cores, both during the forward pulse and reset, be kept to a minimum. Since cores of this size and constant voltage drives of this magnitude are both rarities, potential manufacturers of these cores have been reluctant to guarantee the pulse performance. To overcome this reluctance a study program consisting of both a theoretical analysis and experimental tests was conducted. Specifically, the purpose of the study was to find answers to three key questions. (1) What is the minimum current required in an optimum core? (2) What are the major contributors to deviations from the minimum current? (3) What can be done to insure consistently good cores? Results of the study for cores made of both 1-mil and ½-mil tape are discussed; the major findings being that at these drive levels, eddy currents both within individual wraps and between wraps cause the dominant losses. Recently about 200 such cores were obtained. The measured pulse values are compared with the predicted values. (auth)

1677 MEASUREMENT OF THE OPTIMUM AMPLITUDE-FREQUENCY CHARACTERISTIC OF A 680-MeV SYNCHRO-CYCLOTRON. Enchevich, I. B.; Tomilina, T. N. This paper was summarized in At. Energ. (USSR); 26: 375-6(Apr 1969) as paper No. 282. (In Russian).

A method of determining the optimum amplitude-frequency characteristic of the hf system of a synchrocyclotron without disturbing the vacuum is suggested. The characteristic was plotted for an accelerator in operation so that all factors influencing its operation were automatically taken into account. The amplitude of the accelerating voltage was reduced in such a way that the intensity of the particle beam at the final energy remained unchanged while any additional reduction of the amplitude would have caused particle losses. This amplitude reduction was carried out in the first series of experiments with the help of pulses of widths of 100–200 μsec, subsequently after time intervals of 100 μsec over the whole frequency range of the hf oscillator (the pulse widths exceed the periods of phase fluctuations by many times) and synchronously with the frequency modulation. As regards the necessary power, the smallest amplitude will be optimum which just does not cause a reduction of the particle beam intensity with the highest beam energy possible for the synchrocyclotron considered. In a second series of experiments the amplitude of the accelerating voltage was reduced on sections corresponding to periods of time of 1.0–1.5 μsec. The widths of the modulating pulses fed to the grid of the hf oscillator were synchronized with the modulation frequency and chosen in such a way that they fitted to sections of the characteristic where the amplitudes had to be reduced in order to approach the optimum form. On these sections where a reduction of amplitude caused a strong decrease of intensity, positive pulses were superimposed (in a third series of experiments). In these cases the intensity was raised by 20% although the total requirement of energy was reduced by about 25%. (auth)

1678 ENERGY BALANCE AND EFFICIENCY IN A LINEAR ELECTRON ACCELERATOR WITH AN IRREGULAR WAVEGUIDE. Zhileiko, G. I.; Elemanov, T. E.; Sindinskii, V. V. This paper was summarized in At. Energ. (USSR); 27: 54(Jul 1969) as paper No. 322/5157. (In Russian).

Equations are presented and discussed for studying efficiency, effective accelerating field, and energy balance in an electron linac with an irregular waveguide. The efficiency may be determined either on the basis of the equation for the effective accelerating field obtained by the method of superposition or on the basis of the power-balance equation. From the equations for the effective accelerating field and power balance, the form of the conductivity relationship necessary for calculating the geometrical dimensions of the waveguides is given. (W.H.K.)

1679 BREMSSTRAHLUNG INTENSITY NEAR ACCELERATORS AS A FUNCTION OF ELECTRON ENERGY. Okulov, B. V. This paper was summarized in At. Energ. (USSR); 25: 426(Nov 1968) as paper No. 244. (In Russian).

For the design and maintenance of accelerators the relation $D = Q_M/q(E)$ is studied, where D is the bremsstrahlung dose in R on the axis of the beam at a distance of 1 m from the target, Q_M the number of electrons striking the target, and q(E) the specific charge, i.e., the number of electrons of energy E necessary to produce a dose of 1 R. The relation may be used in designing electron accelerators for a given radiation intensity and also to determine the magnitude of the charge accelerated and dumped on the target to produce the measured dose. (W.H.K.)

1680 ELECTRON BEAM INDICATION FROM RESIDUAL GAS LUMINOSITY. Bikmatov, R. G.; Boriskin, A. G.; Kudelainen, V. I.; Meshkov, I. N.; Parkhomchuk, V. V. This paper was summarized in At. Energ. (USSR); 24: 63-4(Jan 1968) as paper No. 178. (In Russian).

Recently, in studies performed using cyclic accelerators and storage system tracks, various methods for electron beam monitoring from synchrotron radiation monitoring in the visible region of the spectrum have become very popular. A similar technique can be used when the particles themselves do not emit light (linear accelerators, betatrons, heavy-particle accelerators, etc.) but "light up" the residual gas of a specially constructed local molecular jet which they excite. To study the practical possibilities of the method, experiments were performed on a straight 35 keV electron beam and on an ~3 MeV electron beam in a betatron. The luminosity of the residual gas was registered by the FÉU-15A photomultiplier (amplification factor $\sim 10^6$). The current at the photomultiplier output was found to depend linearly upon the residual gas pressure and current in the beam. (W.H.K.)

1681 APPARATUS FOR PROVIDING SHORT BUNCHES OF CHARGED MOLECULAR, ATOMIC, OR NUCLEAR PARTICLES. Mobley, Ralph C. U. S. Patent 3,519,942. 7 Jul 1970. Filed 13 Apr 1966.

A charged-particle beam buncher for an ion source is described. The beam is successively accelerated and decelerated to provide short bunches of charged-particles. (W.H.K.)

1682 MATERIALISATION OF THE MAGNETIC GUIDE FIELD IN THE ISOCHRON-CYCLOTRON AT JUELICH. Thimmel, Hermann Michael. Wiss. Ber. AEG-Telefunken; 43: 67-72(1970). (In German).

The characteristic method of producing AVE magnetic guide fields is described by reference to the isochron–cyclotron at Jülich. First of all the magnetic effects are described, which must be taken into consideration in the design of the pole shoe profile. The stray magnetic field occurring in the pole shoe edge, which determines, too, the radial path of the magnetic field, is influenced by the edge shape. An analogous effect is caused by the stray magnetic field at the azimuthal field edges. In addition the flux compensation occurring in the iron by virtue of the azimuthal field fluctuation entails that the magnetic field distribution in the air gap is dependent on the adjusted flux density. (W.H.K.)

1683 DETERMINING THE MAIN DIMENSIONS OF ELECTROMAGNETS IN IRON-FREE, HIGH-CURRENT BETATRONS. Kunitsyn, G. A. (Tomsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 3, 157-9(1970). (In Russian).

A method of determining the main dimensions of the gap space between the poles of a betatron is worked out for cases of gamma $(\gamma) = r_0/r_c > 1.5$. Here r_0 is the radius of the equilibrium orbit, and r_c is the radius of the region through which the central magnetic flux passes. For values of gamma = 1.5 the error as a rule does not exceed 4%, but at gamma = 2 the error is 12%, and rises to almost 40% at gamma = 3. The selection of the main dimensions depends on the limiting value of the induction in the central part of the electromagnet, the maximum energy of the accelerated electrons, and the intensity. A correction coefficient for the fall in magnetic field with radius is introduced to decrease the design error, especially for values of gamma > 1.5. (TTT)

1684 AUTOMATIC CONTROL SYSTEMS FOR MEDICAL ELECTRON LINEAR ACCELERATORS. Shigemura, Naoshi; Ishida, Shusuke; Harada, Toyoshige (Tokyo Shibaura Electric Co. Ltd.). Toshiba Rebyu; 25: 1040-5(Aug 1970). (In Japanese).

The linear accelerator (Linac) has been used as a most effective tool for cancer treatment. More than 20 sets of the rotational medical Linac, LMR-13, have been manufactured, including those exported to the U. S. A. Their outstanding features are ease of change between X-rays and electron beams as well as high and variable energy (8 to 13 MeV). Three kinds of automatic controllers have been developed: The AFC (automatic frequency controller), ARC (automatic rate controller) and ADC (automatic distribution controller). Through this development, LMR-13 has conspicuously been improved in its stability and reliability. Under any conditions it holds the rate and distribution of dose at a preset level. (auth) (Japan)

1685 PERFORMANCE OF A NEW 4 MeV STANDING WAVE LINEAR ACCELERATOR. Sable, Morris; Gunn, Walter G.;

XUM

Penning, David; Gardner, Angela (O'Connor Hospital, San Jose, Calif.). Radiology; 97: 169-74(Oct 1970).

A new 4 MeV linear accelerator, utilizing a compact standing waveguide accelerator whose x-ray beam is colinear with the electron beam, is described. An output of 350 rads/minute is possible with a sharp beam and a narrow penumbra. Isodose curves are discussed and transverse plots analyzed in detail; decrement lines for different field widths are plotted and their significance established. Also included are rotational aspects and clinical considerations concerning adjacent fields and the dose at depth in the region of various size gaps. (auth)

1686 NONBOILING LIQUID TARGET FOR A HIGH-ENERGY PARTICLE BEAM. Anderson, Robert L. (to United States Atomic Energy Commission). U. S. Patent 3,525,228. 25 Aug 1970. Filed 4 Feb 1969.

A differentially pressurized target system in which heat in a pressurized liquid hydrogen target is transferred by rapid convection currents to one side of a heat exchanger for dissipation on the other side in a liquid hydrogen reservoir that is maintained at atmospheric pressure is described. The rapid convection currents and the difference in pressures in the target and reservoir permits cooling of the target by the liquid hydrogen in the reservoir to a temperature below the boiling point of the liquid target, thus inhibiting boiling of the target liquid upon impingement of a particle beam. (auth)

1687 AUXILIARY CYCLOTRON BEAM MONITOR. Lebowitz, E.; Greene, M. W. (Brookhaven National Lab., Upton, N. Y.). Int. J. Appl. Radiat. Isotop.; 21: 625-7(Oct 1970).

A method is described to overcome the problem, encountered in cyclotron irradiations, of uncertainty in the amount of beam actually striking the target. To check the beam current, a copper foil ($\geq$8mg/cm^2) is irradiated simultaneously backed by an identically shaped target. The cross section for the production in copper of the measured reaction product must be known. If a Ge(Li) detector is used for the radioisotope assay, no chemistry is required and the beam current is calculated from the assay and cross-section data. It is considered that this foil monitor technique has rendered the author's results more reliable and it is suggested for general use. (UK)

1688 ISOCHRONOUS CYCLOTRONS AND THEIR APPLICATIONS. Fenyes, Tibor (Inst. for Nuclear Research, Debrecen, Hungary). Magy. Fiz. Foly.; 18: 110-49(1970). (In Hungarian).

The modern version of cyclotrons, the isochronous or sector-focusing cyclotron, has many applications and satisfies well the heavy-particle accelerator requirements of a small country. The beam current of these machines is orders of magnitude larger than that of the corresponding synchro-cyclotrons; they make it possible to accelarate particles to relativistic energies and the extracted beam may be easily adapted to specific research applications. Both light and heavy particles may be accelarated. The nearly parallel, intensive beams are useful for measuring angular distribution in scattering studies and to examine fission products. The machines may be used for producing neutron-deficient isotopes. Many of the long half-life isotopes, e.g., ^{7}Be, ^{13}N, ^{15}O, ^{22}Na, ^{48}V, etc. cannot be produced by reactor irradiation. Preparations of ^{11}C and ^{63}Zn are of special interest for medical diagnostics and radiation therapy, respectively. The use of these cyclotrons for activation analysis makes it possible to detect impurities in the 10^{-12} g range. They are also used for the study of the superheavy elements. (Review article, 45 references) (TTT)

1689 INVARIANCE PROPERTIES OF SOME BILINEAR AND QUADRATIC FORMS IN CORPUSCULAR OPTICS. Regenstreif, E. (Univ., Rennes, France). Particle Accel.; 1: 271-3(Jul 1970).

The invariance properties of certain combinations of the matrix elements of a beam transport channel are pointed out. These properties can be used, for example, in the analytic determination of the phase acceptance of a quadrupole multiplet. (auth) (UK)

1690 FAST-CLOSING VALVE TO PROTECT AN ACCELERATOR FROM RADIOACTIVE CONTAMINATION. Hahn, R. L.; Stone, R. L.; Tarrant, J. R.; Hunt, L. D. (Oak Ridge National Lab., Tenn.). Nucl. Instrum. Methods; 86: 331-3(1970).

A fast-closing valve system, with annular baffles, has been built to protect the Oak Ridge Isochronous Cyclotron from possible contamination due to intensely alpha-active actinide targets. (auth)

1691 GRONINGEN 5 MV VAN DE GRAAFF ACCELERATOR. Boerma, D. O.; Smith, Ph. B. (Univ., Groningen, Netherlands). Nucl. Instrum. Methods; 86: 221-40(1970).

Many of the design features and construction details of this accelerator were discussed in an early stage of construction and testing. In the period from 1963 to 1967, however, it has been to a large extent rebuilt and rendered serviceable for nuclear research. In the beginning of this period a beam could occasionally be accelerated, mainly for testing purposes (from about July 1964 on), and later on for simple nuclear experiments (since the installation of a new accelerating tube in July 1966). In early 1967 the accelerator was completed. Since then it has been used for 50% to 80% of the time for nuclear experimentation. The experimentor has his choice of analyzed beams of H^+, D^+, $^3He^+$ and $^4He^+$ up to several μA's and at energies up to 6 MeV. This paper contains an essentially complete description of the accelerator itself; the experimental set-ups are not described. (auth)

1692 PHASE COMPRESSION AND PHASE DILATATION IN THE ISOCHRONOUS CYCLOTRON. Mueller, R. W. (AEG-Telefunken, Grosswelzheim, Ger.); Mahrt, R. Nucl. Instrum. Methods; 86: 241-4(1970).

Two examples of phase compression or dilatation effects which may occur in isochronous cyclotrons are derived and explained. The conditions for both examples exist in cyclotrons in use. (auth)

1693 EFFECT ON CHARGED PARTICLE TRAJECTORIES OF HIGHER MULTIPOLARITY COMPONENTS IN A MAGNETIC QUADRUPOLE FIELD. Lobb, D. E. (Univ. of Victoria, Can.). Nucl. Instrum. Methods; 86: 177-87(1970).

The equations of motion for a charged particle in a two-dimensional magnetic quadrupole field with quadrupole or higher multipolarity error fields present have been solved numerically. It is found that the errors in trajectory coordinates as a result of the error components scale approximately linearly with the magnitude of the component and decrease as the multipole order of the error field increases. Simple formulae are presented to calculate an upper limit on these trajectory errors for the particular case of the incident ray normal to the plane of the magnetic field vectors. Curves are presented for some cases of interest. (auth)

1694 METALLIC CHROMIUM TARGET FOR NUCLEAR SCATTERING EXPERIMENTS. Freer, C. M. (King's Coll., London). Nucl. Instrum. Methods; 86: 311(1970).

A pure chromium metal foil target has been made, suitable for medium energy proton scattering experiments. (auth)

1695 SIMPLE BEAM-DIRECTION STABILIZER SYSTEM. Rogers, R. C.; Kenefick, R. A. (Texas A and M Univ., College Station). Nucl. Instrum. Methods; 86: 313-14(1970).

Using inexpensive operational amplifiers and a lamp photoresistor, a relatively simple feedback system with negligible loading effect for automatic centering of an accelerator beam is described. (auth)

1696 PRODUCTION OF TAGGED GAMMAS USING A THIN INTERNAL SYNCHROTRON TARGET. Smith, S. R.; Frisch, D. H.; Gray, S. W.; Newman, D. E.; Shibata, E. I. (Massachusetts Inst. of Tech., Cambridge). Contract AT(30-1)-2098. Nucl. Instrum. Methods; 86: 291-9(1970).

The tagging of the energies of individual high-energy gamma rays in a bremsstrahlung beam by measuring the momentum of the recoil electron is now a standard technique. It is normally used in low intensity external electron beams. We describe a tagging system for photons produced in a quartz fiber target placed in the internal beam of the Cambridge Electron Accelerator. Tagging rates achieved were a few megacycles within a gate having a 10 to 15 per cent duty factor. The maximum photon energy tagged is 5 GeV. By using a very small fiber, adequately low tagging rates can be achieved at machine beam intensities of several milliamps. The target may then be placed in the beam throughout the acceleration cycle, allowing a substantially improved duty factor and not normally interfering with simultaneous use of the machine for other experiments. (auth)

1697 LOWER BOUNDS ON SELF-FOCUSING SO AS TO MAINTAIN RING INTEGRITY NEAR THE INITIATION OF ACCELERATION IN AN ELECTRON RING ACCELERATOR. Pellegrini, C.; Sessler, A. (Univ. of California, Berkeley). Nucl. Instrum. Methods; 86: 273-8(1970).

Relationships necessary for ring stability are derived between the self-focusing forces of an electron ring and the magnetic field gradient defocusing forces present near and just subsequent to the start of ring acceleration. (auth)

1698 USE OF A PHASE SPACE REPRESENTATION FOR THE DESIGN OF A BEAM TRANSPORT SYSTEM WITH DOUBLY ACHROMATIC AND DISPERSIVE MODES OF OPERATION. Hagedoorn, H. L.; Broer, J. W.; Schutte, F. (Eindhoven Univ. of Tech., Netherlands). Nucl. Instrum. Methods; 86: 253-9 (1970).

The beam transport system for the Eindhoven AVF-cyclotron is described. Phase space representation is applied to yield dispersive properties and beam envelopes. The analysis is restricted mainly to a 90° deflecting subsystem composed of two 45° magnets and three magnetic quadrupole lenses. This system allows either

a doubly achromatic or a highly dispersive mode of operation. The analysed beam will have an energy spread of 0.5‰ fwhm with entrance and exit slits of 1 mm width. Currents of 10 μA analysed beam are expected. The total width of the beam does not exceed 20 mm, except horizontally at the position of the two 45° magnets in the dispersive mode. The inner diameter of the beam pipes is 45 mm. (auth)

1699 COMPARATIVE TESTS OF THE PRODUCTION OF POSITIVE HELIUM IONS USING A DUOPLASMATRON WITH THREE ALTERNATIVE APERTURE ARRANGEMENTS. Chapman, K. R.; Hamm, R. W. (Florida State Univ., Tallahassee). Nucl. Instrum. Methods; 86: 199-204(1970).

The production of negative helium ions by a charge exchange source requires an optimum positive beam to be extracted from the duoplasmatron and focused through the exchange region if maximum negative currents are to be produced. Comparative tests are described for three aperture arrangements to determine the positive ion current obtainable and typical parameters for operation. (auth)

1700 PULSE-SHAPE MEASUREMENTS FOR THE OAK RIDGE ELECTRON LINEAR ACCELERATOR WITH GAMMA-RAY DETECTION TECHNIQUES. Weston, L. W.; Todd, J. H. (Oak Ridge National Lab., Tenn.). Nucl. Instrum. Methods; 86: 205-8(1970).

A study of the pulse-shape characteristics of the Oak Ridge Electron Linear Accelerator was carried out because the resolution of neutron cross section and neutron spectra measurements is directly dependent upon this pulse shape. Gamma-ray detection with techniques commonly used in the neutron time-of-flight experiments was used in the study because of the fidelity with which the pulse shape could be measured. (auth)

1701 APPARATUS FOR SEPARATION AND MASS ASSIGNMENT OF ISOTOPES USING TIME OF FLIGHT PRINCIPLE. Navalkar, M. P.; Ramana, J. V. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Pure Appl. Phys.; 7: 478-80(Jul 1969).

An instrument, based on time of flight principle, has been constructed for use as a separator for radioactive isotopes produced in cyclotron irradiations. Constructional details and the performance of the instrument with ions of rubidium, cesium and thallium are reported. Unlike conventional electromagnetic methods, the present equipment, with its high transmission, allows sufficient quantity of an unknown isotope to be collected for assignment of mass number, in addition to providing pure samples for other studies. Other features of the apparatus, viz. resolution, stability and simplicity, compare favorably with those of conventional methods. (auth)

1702 VARIABLE-ORIENTATION MECHANISM FOR POSITIONING SAMPLES. Auguin, Bernard; Noe, Pierre; Riwan, Richard; Viel, Goerges (to Commissariat a l'Energie Atomique). British Patent 1,203,925. 3 Sep 1970. Priority date 31 May 1968, France.

A mechanism with six independent modes of movement for positioning radiation targets is described. (W.H.K.)

1703 MOTION OF SPIN OF PARTICLES IN A STORAGE DEVICE WITH AN ARBITRARY FIELD. Derbenev, Ya. S.; Kondratenko, A. M.; Skrinskii, A. N. (Inst. of Nuclear Physics, Novosibirsk, USSR). Dokl. Akad. Nauk SSSR; 192: 1255-8 (21 Jun 1970). (In Russian).

Study of the behavior of polarized particles in accelerators is usually limited to cases involving constant direction of the magnetic field; this was extended by investigating the motion of spin in storing or accelerating systems with an arbitrary electromagnetic field. The results indicated that if the spin possesses a stable periodic motion, the polarization of the beam in the storing system with the arbitrary field is as stable as in a similar system with an almost stable magnetic field; it was thereby assumed that the orbits are closed. This opens up new possibilities for controlling the polarization in storing systems. (TTT)

PHYSICS (NUCLEAR)

Neutron Interactions with Matter

Refer also to abstracts 381 and 1739.

1704 MOLECULAR INTERACTION EFFECT IN NEUTRON SCATTERING BY GASEOUS METHANE. Fulinski, A. (Jagiellonian Univ., Krakow); Janik, J. A.; Blocki, J. Physica; 48: 126-36(31 Jul 1970).

The influence of the intermolecular interactions within a gas on the scattering of slow neutrons is discussed. The numerical computations are performed for the case of scattering of neutrons by gaseous methane at T = 120 K, P = 1 atm. It is found that the molecular interactions (assumed to be of the form of Lennard-Jones pair potential) diminish the height of the spectrum at the quasi-elastic peak by about 3%. This effect is connected with the attractive part of the interaction potential. (auth)

1705 NEUTRONS WITH AN ENERGY OF LESS THAN 1 MeV IN THE SPECTRA OF (α,n) Be TYPE NEUTRON SOURCES. Fominykh, V. I. At. Energ. (USSR); 28: 159-61(Feb 1970). (In Russian).

Dosimetric determinations require the knowledge of the <1 MeV portion of the neutron spectrum emitted by a source in order to make the necessary corrections in the absolute flux measurements. Therefore, the neutrons emitted by (α,n) Be sources were measured by means of two detectors, one of which possessed maximum sensitivity in the less than 1 MeV range while the other had a constant sensitivity in a relatively broad range. The first detector consisted of a B_2O_3 and ZnS(Ag) mixture placed within a Cd-clad polyethylene sphere; a container with $MnSO_4$ served as the constant sensitivity detector. The sources investigated included the Po-Be, ^{239}Pu-Be, ^{238}Pu-Be, Ac-Be and RaBe(α,n) types. A low-energy group of neutrons was found in practically all (α,n) Be sources; the intensity varied from source to source. Formation of the low-energy group is attributed to the following reaction: $^{9}Be + \alpha \rightarrow {}^{13*}C \rightarrow {}^{8}Be + \alpha + n \rightarrow 3\alpha + n$. Other potential sources include the (n,2n) reaction involving beryllium and elastic collisions of neutrons with beryllium. The efficiency of the detector, the overall neutron flux and the portion with an energy of <1 MeV were tabulated, also including data reported in the literature. (TTT)

1706 NEUTRON SCATTERING IN AIR. Mordashev, V. M. At. Energ. (USSR); 28: 168-9(Feb 1970). (In Russian).

New formulas were obtained for calculating the neutron scattering in air on the basis of the author's earlier study and applying the least-squares method. The results approached the values obtained by earlier investigators who used the Monte Carlo method. The calculations were based on a source placed at a distance r from an isotropic detector and emitting 1 n/sec with an energy E under an angle ϕ. The detection was assumed to record the flux on the dose rate of the neutrons scattered by air or of the γ quanta created by inelastic scattering. Formulas were also derived for calculating the neutron flux scattered by air in the range of E = 0.33 to 14.0 MeV, r = 30.5 to 3.05 m and ϕ = 5° to 180° and for the dose rate due to neutrons, the γ quanta and their dose rate under similar conditions. (TTT)

Nuclear Properties and Reactions, A≤5

Refer also to abstracts 1357, 1553, and 1558.

1707 PHOTOPRODUCTION OF NEUTRAL PIONS ON ^{7}Li. Ramachandran, G.; Prabhakar, N. D.; Rej, A. K. (Indian Statistical Inst., Calcutta). Nucl. Phys.; B20: 369-80(1970).

The photoproduction of neutral pions on ^{7}Li is studied in the elastic as well as in inelastic channels leading to excited states and the relative contributions of the spin-dependent and spin-independent amplitudes to the differential cross sections are estimated. Numerical results obtained using oscillator wave functions are compared with available experimental data at 166 MeV, which leads to a best fit for a value of the nuclear radius parameter r_0 = 1.2 fm. in good agreement with latest electron scattering results. This value is unaltered by taking into account the inelastic contribution leading to the low-lying first excited state. The inelastic differential cross section leading to the 4.63 MeV ($\leq \frac{1}{2}^-$) state is computed using the spin assignments $\frac{5}{2}$ and $\frac{1}{2}$, while that leading to the 11.13 MeV ($\frac{3}{2}^-$) isobaric quartet state is calculated assuming it to be the [21] $^{4}P_{\frac{3}{2}}$ state. The transition to the quartet state is of considerable interest as it involves only the small $F^{(0)}$ term in the photoproduction amplitudes of Chew et al. (auth)

1708 NEUTRON-DEUTERON RADIATIVE CAPTURE AND THE SEAGRAVE-VAN OERS POLE IN THE EFFECTIVE RANGE APPROXIMATION. Bosco, B. (Univ., Florence); Erdas, F.; Mosconi, B.; Pompei, A. Phys. Lett.; 32B: 236-8(6 Jul 1970).

It is shown that the unitarization of the Born approximation with the use of the Van Oers-Seagrave formula, for the radiative capture of thermal neutrons by deuterons to form tritium yields correction to the Born approximation of the same order of magnitude obtained with the use of the classical effective range formula. This is in strong contrast with the results obtained by the use of the Faddeev equation with separable interaction. (auth)

Nuclear Properties and Reactions, 6≤A≤19

Refer also to abstracts 384, 1357, 1555, 1732, 1771, and 1774.

1709 (AD-707999) SCATTERING OF HIGH-ENERGY ELECTRONS BY ^{14,15}N. Dally, E. B.; Croissiaux, M. G.; Schweitz, B. (Stanford Univ., Calif. High-Energy Physics Lab. Strasbourg Univ. (France). Institut de Recherches Nucleaires). Mar 1970. Contract Nonr-225(67). 43p. (HEPL-623). NTIS.

Cross sections of elastic and inelastic electron scattering at incident electron energies of 250 and 400 MeV are presented. Data are given for elastic and inelastic scattering from ^{15}N and elastic scattering from ^{14}N. The data are analyzed with the use of the shell model, in Born approximation. (auth) (USGRDR)

1710 (ANL-7641) PHYSICS DIVISION SUMMARY REPORT, APRIL-SEPTEMBER 1969. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 130p. Dep. CFSTI.

Research progress at the Argonne National Laboratory Physics Division in the period April through September 1969 is reported. Some previously unreported highlights include operation of the 4-MV Dynamitron facility, installation of the split-pole magnetic spectrograph at the tandem Van de Graaff accelerator, experiments on heavy-ion scattering, Moessbauer isomer shift in ^{243}Am, and polarization of heavy particles. (J.W.R.)

1711 (LYCEN-7033) THE STUDY OF (α,2α) REACTIONS WITH LIGHT NUCLEI. Pizzi, Jean-Rene (Lyon Univ. (France). Institut de Physique Nucleaire). Apr. 1970. 54p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis.

The method of calculating the differential cross section for the (α,2α) reaction using the impulse approximation was recalled. The associated experimental techniques were described. The quasi elastic (α,2α) scattering by the nuclei of ^{6}Li, ^{7}Li, ^{9}Be, ^{12}C and ^{16}O were studied for an incident energy of 55 MeV. The momentum distribution of the cluster in the nuclear targets was determined by two methods: an angular distribution method and an energy distribution method. (auth) (France)

1712 TABLE OF RADIOACTIVE NUCLIDES ARRANGED IN ASCENDING ORDER OF HALF-LIFE. Large, N. R.; Bullock, R. J. (Atomic Energy Research Establishment, Harwell, Eng.). Nucl. Data, Sect. A; 7: 477-94(May 1970).

The radioactive nuclides are presented in order of ascending half-life together with indications of their respective decay modes. The half-life data were obtained from the "Table of Isotopes," 6th edition, supplemented by Recent References in Nuclear Data. (auth)

1713 THRESHOLD RESONANCES. Tindle, C. T. (Univ. of British Columbia, Vancouver). Can. J. Phys.; 48: 1747-58(1 Aug 1970).

A comparison is made of the way R-matrix and S-matrix theories analyze the threshold resonances which occur in the scattering of neutral particles by a square well. Both approaches are found to provide very good approximate formulas. However, modifications of the usual S-matrix expansions must first be made. The behavior of the energy of the threshold level is quite different in the two alternatives. By comparing the two theories in their interpretation of the low-energy neutron cross sections of ^{1}H, ^{16}O, and ^{208}Pb it is concluded that R-matrix theory provides a better interpretation for unbound levels and S-matrix theory is preferable when the threshold level is bound. (auth) (Canada)

1714 ELECTRODISINTEGRATION OF LITHIUM. Wong, C. F.; Hutcheon, R. M.; Shin, Y. M.; Caplan, H. S. (Saskatchewan Accelerator Lab., Saskatoon). Can. J. Phys.; 48: 1917-23 (15 Aug 1970).

Energy spectra of charged particles produced by electron and bremsstrahlung bombardment of ^{6}Li and ^{7}Li were measured by means of a magnetic spectrometer and solid-state detectors. Assuming that all transitions leave the residual nucleus in the ground state, the photonuclear cross sections were obtained using both bremsstrahlung and E1 virtual photon spectra. Comparison of the present real and virtual photon results is made with those of previous experiments. (auth) (Canada)

1715 STUDY OF TWO ELECTROMAGNETIC TRANSITIONS BETWEEN THE THREE FIRST STATES $J^{\pi} = 2^{+}$ OF ^{16}O. Brochard, F.; Chevallier, P.; Disdier, D.; Rauch, V.; Scheibling, F. (Centre National de la Recherche Scientifique, Strasbourg). J. Phys. (Paris); 31: 255-7(Apr 1970). (In French).

Measurements were made on the transitions: 9.85 ($J^{\pi} = 2^{+}$) → 6.92 MeV(2^{+}) and 11.52(2^{+}) → 6.92 MeV with the aid of the ^{12}C(α,γ)^{16}O reaction. The deduced partial widths were Γ(9.85 → 6.92 MeV = (2.2 ± 0.4) MeV Γ(11.52 → 6.92 MeV) = (29 ± 7) MeV. (auth) (France)

1716 NUCLIDIC MASS MEASUREMENT BY ION CYCLOTRON RESONANCE AND ISOTOPIC ABUNDANCE-RATIO MEASUREMENT BY PROTON RESONANCE SATELLITES. Fujiwara, Shizuo (Tokyo Univ.). pp 361-9 of Magnetic Resonance. /Coogan, C. K. (ed.). New York; Plenum Publishing Corp. (1970).

From International Symposium on Electron and Nuclear Magnetic Resonance, Melbourne, Australia. See CONF-690839.

An apparatus was built for determining the mass of an ion by measuring the magnetic field for a cyclotron frequency, using a proton magnetic resonance technique. Measurements were carried out on ^{40}Ar; the result is 39.970 ± 0.001. This technique can also be applied to measure the gyromagnetic ratio or the magnetic dipole moment. NMR spectra of protons in organic and organometallic complexes often show satellites due to spin coupling of protons with ^{13}C. This effect was used to measure the relative abundances of ^{199}Hg in CH_3HgCl, ^{10}B and ^{11}B in $NaBH_4$, ^{13}C in $CHCl_3$, and ^{29}Si in $SiHCl_3$. The results agree with those obtained by mass spectroscopy. Factors and errors affecting the measurements are discussed. (For the lead abstract to this conference, see NSA 24: 2661). (D.L.C.)

1717 DIFFERENTIAL CROSS SECTIONS OF PROTON ELASTIC SCATTERING ON Be NUCLEI AND THE TOTAL CROSS SECTION OF REACTION ^{9}Be(p,n)^{9}B NEAR THRESHOLD. Siksin, V. S.; Domoratskii, V. N.; Donetskov, L. V.; Voronin, A. N.; Novikov, M. M.; Kudryavtsev, A. N.; Batyshchev, G. D.; Barvin, S. K.; Tseshkovskaya, V. F. (Rostov State Univ., Rostov-on-Don, USSR). Yadern. Fiz.; 12: 15-25(Jul 1970). (In Russian).

Differential cross sections of proton elastic scattering on Be nuclei and the total cross section of reaction ^{9}Be(p,n)^{9}B were measured near the threshold. On the curves of energy dependences of differential cross sections of proton elastic scattering simultaneously measured at angles of 45, 83°30′ and 135° in lab. system, resonances were observed. The density of the resonances is high. The curve for the ratio σ/v also has resonance structure which is correlated with that in the scattering cross section. On the curve of the total cross section of reaction ^{9}Be(p,n)^{9}B a narrow resonance peak is observed near the threshold. At this energy of incident protons the angular distribution of resonantly scattered protons is isotropic. With the increase of proton energy corresponding to the sharp increase of the neutron emission, the angular distribution of resonantly scattered protons also slightly differs from the isotropic one. At a distance from the neutron threshold towards lesser and larger proton energies the asymmetry in the resonance proton emission increases with preferred "forward" emission. The narrow resonance peak near the threshold of (p,n) reaction and corresponding in energy resonance peaks on the scattering curves, seem to be due to the s state of the neutron relative to ^{9}B nucleus. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 89

Refer also to abstracts 384, 1357, 1694, 1710, 1712, and 1736.

1718 (LYCEN-7013) A CONTRIBUTION TO THE STUDY OF THE ^{28}Si(d,p)^{29}Si REACTIONS AT LOW ENERGIES (1 TO 3 MeV). Descroix, Etienne (Lyon Univ. (France). Institut de Physique Nucleaire). Mar 1970. 57p. (In French). Dep. CFSTI (U. S. Sales Only).

Thesis.

The ^{28}Si(d,p)^{29}Si reactions between 1 and 3 MeV were studied with the intention of revealing the mechanism of these reactions at low energies. The equipment used, the detection system, and the associated electronics were described in detail. The problems which must be resolved concerning impurities in the targets, the thickness of the targets, the energy of the beam, and the calculation of the cross sections, were recalled. In order to interpret the results theoretically, it was necessary to study in parallel the elastic scattering of the dueterons by Si, and obtain the input parameters of the optical model. Agreement between the experimental curve and the theoretical curve obtained by the DWBA method was only possible for the higher energies (2.8 to 3 MeV), and the two first levels. The difficulty appears to arise from the compound nucleus, whose fluctuating and asymmetric character was revealed by the experimental curves. (auth) (France)

1719 (NYO-2171-321) SHAPES OF ANGULAR DISTRIBUTIONS OF (^{3}He,t) AND (p,n) TRANSITIONS TO 0^{+} ANTI-ANALOG STATES. Noble, J. V. (Pennsylvania Univ., Philadelphia. Dept. of Physics). 1 Oct 1970. Contract AT(30-1)-2171. 8p. Dep. CFSTI.

The anomalous ($\Delta L = 1$) shapes of the angular distribution of tritons from the $0^{+} - 0^{+}$ ^{3}He-induced charge-exchange transitions to anti-analog states of ^{64,66}Ga and ^{40}K can be understood on the basis of the structural relation between analog and anti-analog states, together with the assumption of a pure charge-exchange (i.e., no knockout) mechanism. (auth)

1720 (TID-25547) DECAY OF NEUTRON DEFICIENT NUCLIDES OF MASS 89. Hagenauer, Richard Carl (Oak Ridge National Lab., Tenn.). Mar 1969. 121p. Dep. NTIS.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

The decays of ^{89g}Zr, ^{89m}Zr, ^{89g}Nb, and ^{89m}Nb were studied using anthracene, NaI, and Ge(Li) detectors. Gamma singles and coincidence spectra as well as β^{+} spectra were measured. Half-lives were determined and decay schemes to levels in ^{89}Y and ^{89}Zr were established. In addition, a search for the decays of ^{89g}Mo and ^{89m}Mo was performed, and upper limits for the half-lives were determined. The data were compared with predictions made using the shell model modified by the "effective interaction" method. (J.W.R.)

1721 GAMMA RAYS FOLLOWING THE DECAY OF ^{65}Ga. Holmberg, P.; Kiuru, A.; Luukko, A. (Univ. of Helsinki). Acta Phys. Pol.; B1: 59-63(1970).

In a study of the decay of 15 min ^{65}Ga, about eight new gamma rays were found, and in all, twenty-five gamma transitions were observed. A level scheme was constructed. Levels not reported earlier in the decay studies of ^{65}Ga were found at 910 keV and 2419 keV. Gamma-ray energy and intensity values are given, and branching ratios for the β^{+}—decay and EC-processes are deduced. Corresponding log ft values were also calculated. (auth)

1722 DOUBLE CHARGE-EXCHANGE SCATTERING OF PIONS BY ^{51}V AND ^{90}Zr IN THE RESONANCE REGION. Bjoernenak, K. (Fysisk Institutt, Trondheim, Norway); Finjord, J.; Osland, P.; Reitan, A. Nucl. Phys.; B20: 327-32(1970).

The differential cross section for double charge-exchange scattering of pions on ^{51}V and ^{90}Zr is calculated in the Glauber approximation, for pions in the resonance region and for transitions leading to the analogue states in ^{51}Mn and ^{90}Mo. It is shown that the rescattering of the pion on the core nucleons leads to a considerable suppression of the scattering amplitude, which explains the small cross sections that are observed in recent experiments. (auth)

1723 γ SPECTRA FROM REACTION (n,γ) OF THERMAL NEUTRONS ON ^{70}Ge, ^{72}Ge, AND ^{73}Ge NUCLEI. Rudak, E. A.; Firsov, E. I.; Khil'manovich, A. M. Vesti Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 1, 95-100(1970). (In Belorussian).

The γ spectra from thermal neutron capture by ^{70}Ge, ^{72}Ge, and ^{73}Ge were studied using a magnetic Compton spectrometer with 2% resolution. (J.W.R.)

1724 γ SPECTRA FROM REACTION (n, γ) OF THERMAL NEUTRONS ON NATURAL MIXTURE OF ISOTOPES OF MAGNESIUM. Rudak, E. A.; Firsov, E. I.; Khil'manovich, A. M. Vestsi Akad, Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 1, 25-6 (1970). (In Russian).

The γ spectra from thermal neutron capture by natural magnesium were studied using a magnetic Compton spectrometer with 2% resolution. (J.W.R.)

1725 REFERENCES FOR NEUTRON-CAPTURE CONVERSION-ELECTRON MEASUREMENTS. von Egidy, T. (Technische Hochschule, Munich). Nucl. Data, Sect. A; 7: 465-76 (May 1970).

XUM

The table gives as completely as possible references for all papers on measurements of conversion electrons emitted after slow neutron capture. Results from the first experiments in 1938 to work in December 1969 are covered. The more recent data were obtained with the electron spectrometers at Moscow, Munich, Studsvik, Riga, Leningrad, and Argonne. Short descriptions of these instruments are included. (auth)

1726 THE $^{29}Si(p,\gamma)^{30}P$, AND $^{29}Si(p,p'\gamma)^{29}Si$ REACTIONS FROM 1300 TO 1850 keV. Din, G. V. (Australian National Univ., Canberra). Aust. J. Phys.; 23: 261-73(Jun 1970).

Proton capture resonances in the $^{29}Si(p,\gamma)^{30}P$ reaction and the yield of 1.27 MeV γ-rays from inelastic scattering of protons from ^{29}Si have been studied in the proton energy range 1300 to 1850 keV. The measurements were made using thin enriched $^{29}SiO_2$ targets on tungsten backings with a proton beam energy resolution of 1 keV. Sixteen resonances of widths between 1 and 7 keV were observed in the $^{29}Si(p,\gamma)^{30}P$ reaction and eight resonances in the $^{29}Si(p,p'\gamma)^{29}Si$ reaction. The resonances at 1324, 1748, and 1772 keV were found to be doublets. (auth)

1727 $^{24}Mg(\alpha,\alpha')^{24}Mg_{1.37}$ REACTION AT BOMBARDING ENERGIES OF 9 TO 14 MeV. Sauter, Alvin Harold. Bloomington, Ind.; Indiana Univ. (1969). 283p. University Microfilms Order No. 70-7502.

Thesis.

The $^{24}Mg(\alpha,\alpha')^{24}Mg$ reaction was studied in the alpha-particle bombarding energy range of 9 to 14 MeV. The experimental data include (α,α') differential cross section measurements obtained over the laboratory angular range of 25 to 160° in 3° steps, and at 90 energies approximately equally spaced (~40 keV apart) throughout the 9.625 to 13.825 MeV energy range. Also, alpha–gamma angular correlation measurements were made at 12 energies in the 11.90 to 13.50 MeV energy interval. These consist of the coincidence yield between the inelastically scattered alpha particles and the 1.37-MeV deexcitation gamma rays from the residual ^{24}Mg nucleus. A coincidence gamma-ray angular distribution was measured in the reaction plane at 28 alpha-particle scattering angles for each of the 12 energies. The statistical fluctuation analysis methods proposed by Ericson are appropriate for the differential cross section data (excitation functions), and such an analysis was carried out. An auto-correlation analysis yields a value for the average compound nucleus level width of 64 keV, and this number is consistent with other experiments. A further statistical analysis result indicates that the direct reaction (non-fluctuation) contribution to the observed cross sections is about 50%. The presence of intermediate-width structures in the cross sections as revealed by the statistical analysis, and as more directly shown by the angular correlation data, constitutes strong evidence in favor of the doorway state hypothesis in the unified theory of nuclear interactions of Feshbach. (Diss. Abstr. Int., B)

1728 POLARIZATION FROM ELASTIC AND INELASTIC SCATTERING OF 6 TO 10 MeV-PROTONS BY ^{24}Mg. Borsaru, M.; Cenja, C.; Hategan, C.; Tanase, M. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 15: 555-8(1970).

The angular distributions of the polarization at five proton energies in the 6 to 10 MeV energy range are reported. The optical model calculations using the parameters given by Rosen are compared with elastic scattering data. (auth)

1729 (α,p) REACTION ON THE ODD NUCLEI ^{63}Cu, ^{65}Cu, AND ^{59}Co. Bucurescu, D.; Ivascu, M.; Semenescu, G. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 15: 621-4(1970).

The angular distributions of (α,p) reactions on ^{59}Co and $^{63,65}Cu$ were measured. The measurements were made at bombarding energies of 19.2 MeV for ^{59}Co and 19.4 MeV for $^{63,65}Cu$. The results show that the shape of the angular distributions can indicate that one of the possible (l,j) transfers predominates in reactions of this type. (J.W.R.)

1730 LEVELS IN MEDIUM-WEIGHT EVEN–EVEN NUCLEI POPULATED BY ^{66}Cu, ^{68}Ga, ^{132}Cs, ^{132}I. Carter, Hubert Kennon. Nashville; Vanderbilt Univ. (1969). 168p.

Thesis.

The decay of ^{66}Cu to ^{66}Zn was studied to search for a 2372-keV level previously observed in the ^{66}Ga decay and to measure its spin. Singles and coincidence studies show the following levels are populated in ^{66}Zn: 1039.2 ± 0.2, 2+; 1872.2 ± 1.0, 2+; and 2371.7 ± 1.5, 0+, keV. The spin of the 2372-keV level, previously unreported in the ^{66}Cu decay, was determined to be 0 by gamma–gamma directional correlation studies of the 1039- 1332-keV cascade (A_2 = 0.49 ± 0.32 and A_4 = 1.16 ± 0.44). The gamma rays following the decay of ^{68}Ga were studied in singles and coincidence modes. The observed levels in ^{68}Zn are as follows: 1077.4 ± 0.2, 2+; 1655.7 ± 1.0, 0+; 1883.4 ± 0.3, 2+; 2338.7 ± 0.4, 2+; and 2823.8 ± 1.0, 2+ keV. A 578.3-keV transition and the level at 1655.7 keV it depopulates are previously unreported in the beta decay of ^{68}Ga. The spin of the 1655-keV level was determined to be 0 by gamma–gamma directional correlation experiments on the 578- 1077-keV cascade (A_2 = 0.21 ± 0.14 and A_4 = 1.35 ± 0.27). The level structure of ^{132}Xe was studied by the radioactive decay of ^{132}Cs and ^{132}I. The energies and intensities of twelve transitions in the decay of ^{132}Cs were determined with improved accuracy. The level energies in ^{132}Xe determined from these results are 667.65 ± 0.09, 1297.6 ± 0.2, 1440.1 ± 0.4, 1803.4 ± 0.2, and 1985.3 ± 0.2 keV. The first two excited states in ^{132}Ba are at 464.5 ± 0.2 and 1031.4 ± 0.2 keV. The decay of ^{132}I was studied with Ge(Li) detectors and also with a 30 cm^3 Ge(Li)–3 × 3 $in.^2$ NaI multiparameter coincidence system. The energies and relative intensities of 108 gamma rays were measured. NaI energy gates centered at the following energies were investigated: 515, 630, 667, 772, 800, 954, 1110, 1170, 1270, and 1410 keV. Relative coincidence intensities were obtained for the strongest transitions in each of the gates. The K-conversion lines of transitions in the decay of ^{132}I were measured. The following levels are supported by accurate energy-sum relations and the present coincidence data (tentative assignments in parentheses): 667.67, 2+; 1297.84, 2+; (1439.4, (0+)); 1440.27, 4+; 1803.66, 3+; 1962.93, (3,4)+; 1985.3, 2(+); 2110.18, (3,4)+; 2111.8, (5,6)+; 2350.67, (3,4,5); 2394.93, (3,4)+; 2424.89, (3,4)+; 2583.75, (3,4,5)+; 2588.66, (3,4); 2613.50 (3,4,5)+; 2669.95, (3,4)+; 2754.43, (3,4); 2838.70, (3,4,5)+; 2840.29, (3,4,+); (2886.2); 2890.74, (3,4); 3058.17, (3,4) keV. (Diss. Abstr. Int., B)

1731 THERMAL NEUTRON CAPTURE CROSS-SECTIONS AND RESONANCE CAPTURE INTEGRALS OF ^{44}Ca, ^{62}Ni, ^{168}Yb, ^{174}Yb, ^{169}Tm, AND ^{203}Tl. Sims, G. H. E.; Juhnke, D. G. (Atomic Energy of Canada Ltd., Ottawa). J. Inorg. Nucl. Chem.; 32: 2839-44(Sep 1970).

The effective neutron capture cross sections of the above isotopes were measured by the activation method. By irradiating samples with and without cadmium covers, and by assuming a 1/v dependence in the sub-cadmium region, the 2200 m/sec cross sections and the resonance integrals were calculated using the Westcott convention. The values for σ_0 were ^{44}Ca 0.88 ± 0.01 barns, ^{62}Ni 14.2 ± 0.3 barns, ^{168}Yb 3470 ± 50 barns, ^{174}Yb 141 ± 2 barns, ^{169}Tm 106 ± 3 barns, and ^{203}Tl 8.9 ± 0.4 barns. The resonance integrals (Σ) were ^{44}Ca 0.56 ± 0.01 barns, ^{62}Ni 9.6 ± 3.5 barns, ^{168}Yb 21000 ± 4200 barns, ^{174}Yb 68.6 ± 7.2 barns, ^{169}Tm 2240 ± 130 barns, and ^{203}Tl 349 ± 17 barns. All measurements were relative to a ^{59}Co cross section of 37.5 barns and a ^{59}Co resonance integral of 69.9 barns. (auth) (UK)

1732 CONTRIBUTION OF THE FINAL STATE INTERACTION IN THE (p,2p) AND $(\alpha,2\alpha)$ REACTIONS. Mithra, Benoit; Laverriere, Roger (Univ. de Lyon, Villeurbanne, France). Compt. Rend., Ser. B; 271: 158-61(15 Jul 1970). (In French).

The contributions of the various graphs of the dispersion theory are examined taking into account the final state interaction. Calculations of the angular distributions for symmetric coplanar geometry are made for the following reactions: (p,2p) with ^{32}S and ^{40}Ar at 460 MeV and $(\alpha,2\alpha)$ with ^{16}O at 25 MeV. Good agreement is obtained between the description of the phenomena and experimental results. (auth) (France)

1733 PROTON POLARIZATION IN $p^{20}Ne$ SCATTERING AT 1.5 TO 2.4 MeV. Soroka, V. I.; Mal'ko, A. I.; Chirko, V. I. (Inst. of Physics, Kiev). Yadern. Fiz.; 12: 26-9(Jul 1970). (In Russian).

Proton polarization was measured from the scattering $p-^{20}Ne$ at 60 and 90° in lab. system at 1.5 to 2.4 MeV, using the scattering on Si to obtain the polarized beam. The polarization degree is calculated in the approximation of dispersion theory. In calculations, the results of analysis of the experimental data on $p-^{20}Ne$ scattering cross section, were used. The experimental data are in agreement with the calculation assuming the 4.17-MeV level of ^{21}Na nucleus to have spin and parity $\frac{3}{2}^-$ and the 4.47-MeV level $-\frac{3}{2}^+$. (auth)

1734 HIGH ENERGY ELECTRON SCATTERING ON ISOTOPES ^{24}Mg AND ^{26}Mg. Khvastunov, V. M.; Afanas'ev, N. G.; Afanas'ev, V. D.; Bondarenko, E. V.; Gulkarov, I. S.; Savitskii, G. A.; Shevchenko, N. G. (Physical-Technical Inst., Kharkov). Yadern. Fiz.; 12: 9-14(Jul 1970). (In Russian).

Elastic and inelastic scattering of 225-MeV electrons on ^{24}Mg and ^{26}Mg was measured. The data were analyzed in the Born approximation. Analyzing the elastic scattering with the homogenous Gaussian charge distribution one finds that addition of two neutrons to the ^{24}Mg nucleus results in a rise of the R parameter by 0.03 ± 0.02 f and in a decrease of the g parameter by 0.07 ± 0.04, which corresponds to the decrease of the mean square radius of the ^{26}Mg nucleus by (1.6 ± 1.3) % as compared with ^{24}Mg. Analysis of the inelastic scattering with excitation of the first 2^+ levels shows that

the internal quadrupole moments of the nuclei ^{24}Mg and ^{26}Mg are equal up to the experimental errors. (auth)

Nuclear Properties and Reactions, A ≥ 90

Refer also to abstracts 186, 355, 379, 402, 460, 1357, 1712, 1713, 1722, 1725, 1730, and 1731.

1735 (BNL-tr-351) SOME NEW DATA ON NEUTRON SPECTROSCOPY OF HEAVY NUCLEI. Sukhoruchkin, S. I. Translated by S. J. Amoretty (Brookhaven National Lab., Upton, N. Y.). At. Energ. (USSR); 28: 38-46(1970). 26p. Dep. CFSTI.

Some new features in the data on neutron spectroscopy of heavy nuclei obtained in the last two or three years are examined. Some of them, such as structure in subthreshold fission, seem to have been established fairly reliably; others, such as the spin dependence of the strength function and the systematic variation of radiation widths, must still be verified. Intermediate structure in the cross sections (on the scale of 1 keV) of heavy nuclei are considered, and the agreement between recent experimental data and the earlier assumptions about the statistical nature of the properties of neutron levels is examined. The areas treated are radiation widths of heavy nuclei, fission widths of the neutron resonances, dependence of the neutron strength function on the spin of the compound nucleus, and level-spacing distributions. (R.W.R.)

1736 (INR-1197) PROGRESS REPORT ON NUCLEAR DATA RESEARCH IN POLAND, MAY 1969–APRIL 1970. Marcinkowski, Andrzej (comp.) (Institute of Nuclear Research, Warsaw (Poland)). 1970. 40p. Dep. CFSTI (U. S. Sales Only).

ANTIMONY-123—neutron reactions (n,2n) at 14.5 MeV, isomeric cross section for, (E)
BARIUM-137—neutron inelastic scattering at 14.5 MeV, isomeric cross section for, (E)
BARIUM-138—neutron reactions (n,2n) at 14.5 MeV, isomeric cross section for, (E)
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DYSPROSIUM-163—neutron reactions (n,α) at 14.2 MeV, α spectra from, (E)
DYSPROSIUM-164—neutron reactions (n,α) at 14.2 MeV, α spectra from, (E)
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NUCLEI—neutron reactions (n,α) with, analysis for cluster structure in nuclear surface by, (T)
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SELENIUM-78—neutron reactions (n,2n) at 14.5 MeV, isomeric cross section for, (E) (J.W.R.)

1737 (LYCEN-7014) REACTIONS INDUCED IN GOLD BY DEUTERONS OF ENERGIES UP TO 60 MeV. Chevarier, Noelle (Lyon Univ. (France). Institut de Physique Nucleaire). Mar 1970. 42p. (In French). Dep. CFSTI (U. S. Sales Only). Thesis.

The excitation functions induced in ^{197}Au by deuterons in the 10 to 60 MeV energy range were studied. The reactions: (d,2n), (d,3n), (d,4n), and (d,t) were of interest; the reaction (d,3n) leading to the formation of a stable residual nucleus, necessitated an analysis for mercury traces. The statistical compound nucleus model yielded results which are correct in regard to the position of the energy maximum and its amplitude. In order to interpret the tail of the excitation function curve at high energies, the statistical model proposed by Griffin was used. The association of these two models led to satisfactory results. (auth) (France)

1738 (LYCEN-7051) STUDY OF THE 81-NEUTRON NUCLEUS OF ^{141}Nd. Duffait, Roger (Lyon Univ. (France). Institut de Physique Nucleaire). Jul 1970. 43p. (In French). Dep. NTIS (U. S. Sales Only).

Thesis. Submitted to Univ. of Lyon, France.

The nuclear level scheme of ^{141}Nd was established from a study of the decay of ^{141}Pm into ^{141}Nd using gamma ray spectrometry and measurements made on the conversion electron spectra. The level scheme of ^{141}Nd was in satisfactory agreement with those obtained by other workers from nuclear reactions. The nature of most of the levels was interpreted in terms of the unified model. The ^{141}Nd nucleus was considered as being of the even-even type (60 protons, 82 neutrons) with a neutron hole. Analogies and differences between schemes for nuclei of odd mass possessing 81 neutrons were studied. (auth) (France)

1739 (NYO-73-293) PROGRESS REPORT [ON NUCLEAR PHYSICS], JANUARY 1969–DECEMBER 1969. (Columbia Univ., New York. Pegram Nuclear Physics Labs.). Contract AT(30-1)-73. 215p. Dep. CFSTI.

ALPHA SPECTROMETERS—background reduction in
CESIUM-133—nuclear electric and magnetic moments of, (E)
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CHROMIUM-53—energy levels from chromium-52 (d,p) reaction, (E)
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SAMARIUM-154—neutron resonance parameters and capture integrals, (E)
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—operation experience with
YTTERBIUM ISOTOPES—neutron resonance parameters for, (E)

1740 $g_{9/2}-d_{5/2}$ INTERACTIONS IN ^{96}Nb AND ^{92}Nb. Comfort, J. R.; Maher, J. V.; Morrison, G. C.; Schiffer, J. P. (Argonne National Lab., Ill.). Phys. Rev. Lett.; 25: 383-6(10 Aug 1970).

The reaction ^{96}Zr(^{3}He,t)^{96}Nb was studied and six states belonging to the $(\pi g_{9/2})(\nu d_{5/2})^{-1}$ configuration were identified. The energies and spin assignments agree well with those derived by use of the

Pandya transformation from the known states of ^{92}Nb belonging to the $(\pi g_{9/2})(\nu d_{5/2})$ configuration. (auth)

1741 PRODUCTION OF RARE-EARTH alpha EMITTERS WITH ENERGETIC ^{3}He PARTICLES; NEW ISOTOPES: ^{151}Er, ^{156}Yb, AND ^{157}Yb. Toth, K. S. (Oak Ridge National Lab., Tenn.); Hahn, R. L.; Ijaz, M. A.; Sample, W. M. Phys. Rev., C; 2: 1480-90(Oct 1970).

Alpha-active isotopes in the rare earth region were investigated by bombarding ^{156}Dy and ^{162}Er targets with ^{3}He ions accelerated in the Oak Ridge isochronous cyclotron. In the experiments recoil nuclei ejected from the thin targets were stopped in helium gas, swept through an orifice, and deposited on catcher foils. After each bombardment the activity collected on the catchers was assayed with an α Si(Au) spectrometer. For ^{156}Dy targets relative yields were obtained as a function of bombarding energy for known erbium, holmium, and dysprosium nuclides. Excitation functions determined from statistical-model calculations were found to be in reasonable agreement with the shapes of the experimental (^{3}He,xn) and (^{3}He,pxn) curves but not with those of the (^{3}He,αxn) curves. Experimentally, the yields for (^{3}He,pxn) and (^{3}He,αxn) products were found to be ~3 to 5 times greater than those for (^{3}He,xn) products. The statistical-model calculations, contrastingly, indicated the (^{3}He,xn) and (^{3}He,pxn) cross sections to be comparable and ~5 times greater than those for (^{3}He,αxn) products. Similar yields were measured for nuclides observed in bombardments of the ^{162}Er target and were used in the assignment of two new α-emitting isotopes to ^{156}Yb and ^{157}Yb. Their half-lives and α-decay energies were measured to be: (1) ^{156}Yb, 24 ± 1 sec, 4.80 ± 0.01 MeV, and (2) ^{157}Yb, 34 ± 3 sec, 4.50 ± 0.01 MeV. The assignment of the 4.80-MeV α group to ^{156}Yb was clearly established by noting a generic relationship between it and its known α-decay daughter, ^{152}Er. A similar clear-cut confirmation, based on a generic relationship, was not possible for ^{157}Yb. The previously unknown nuclide, ^{151}Er, was found in the ^{156}Dy bombardments by noting an initial growth period in the 4.60-MeV α-particle group known to follow the decay of its daughter, ^{151m}Ho. From this growth the half-life of ^{151}Er was found to be 23 ± 2 sec. The existence of 5.3-min ^{155}Er, previously observed by us in ^{4}He bombardments of ^{156}Dy, was confirmed. Its α-decay energy was measured to be 4.01 ± 0.01 MeV, in agreement with the value reported earlier. (auth)

1742 NUCLEAR INTRINSIC QUADRUPOLE MOMENTS AND DEFORMATION PARAMETERS. Loebner, K. E. G. (Univ., Freiburg i. B. Technische Hochschule, Munich); Vetter, M.; Hoenig, V. Nucl. Data, Sect. A; 7: 495-564(May 1970).

Presented here are averaged values for the intrinsic quadrupole moment, Q_0, and different deformation parameters, β_q, β, ϵ, δ, $\eta\kappa$, and δ', of deformed nuclei in the rare-earth region, $150 < \approx A < \approx 190$, and in the actinide region, $A > \approx 220$. The arrangement is by Z and A. These values are calculated from: Electric quadrupole hyperfine interaction of nuclei in atoms and molecules, Mu-mesonic x-ray measurements, Electric giant-dipole resonance measurements, Experimental B(E2)-values between rotational states and the ground state of nuclei (obtained from Coulomb excitation and half-life measurements), and Reorientation effect in Coulomb excitation. The literature has been covered to September 1969. Exact definitions for the different deformation parameters are given and relations between them are displayed. (auth)

1743 THE 2s ATOMIC LEVEL IN MUONIC ^{140}Ce. Jenkins, D. A. (Virginia Polytechnic Inst., Blacksburg); Powers, R. J.; Martin, P.; Miller, G. H.; Welsh, R. E.; Kunselman, A. R. Phys. Lett.; 32B: 267-9(6 Jul 1970).

The 2s → 2p and the 3p → 2s muonic x-ray doublets in ^{140}Ce were observed. Assuming a two-parameter Fermi distribution the data are best fit by allowing a 5.4 ± 0.7 keV shift downward in the $1s_{1/2}$ level in reasonably good agreement with the theoretical calculations for nuclear polarization. The sensitivity of the results to a three-parameter Fermi distribution is explored. (auth)

1744 INTERNAL CONVERSION COEFFICIENTS ON M_{I-III} SUBSHELLS OF ATOM (Z = 94) WITH THE CALCULATION OF SCREENING ACCORDING TO GASPAR WITH SEMI-EMPIRICAL CORRECTION. Barbisaglebski, L. A.; Trusov, V. F.; Shulyakovski, G. S. Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 1, 101-6(1970). (In Belorussian).

The M_{I-III} internal conversion coefficients for Z = 94 atoms were determined by numerical integration of the system of Dirac differential equations. The Gaspar semi-empirical correction was used to account for the effects of screening and finite nuclear dimensions. The results are compared with values given in the tables of Rouza. (J.W.R.)

1745 PAIRING PHASE TRANSITION IN THE Yb ISOTOPES. Oothoudt, M.; Hintz, N. M.; Vedelsby, P. (Univ. of Minnesota, Minneapolis). Phys. Lett.; 32B: 270-2(6 Jul 1970). (COO-1265-89).

Excited L = 0 transitions are seen with considerable strength in the (p,t) reaction on ^{176}Yb, and with rapidly decreasing strength on the lighter Yb isotopes. The observations indicate a phase transition for a normal to a superconducting ground state as N decreases. (auth)

1746 NUCLEAR DEFORMATION ENERGY IN THE TWO-CENTER SHELL MODEL. Albrecht, K. (Univ., Frankfurt am Main); Scharnweber, D.; Greiner, W.; Mosel, U. Phys. Lett.; 32B: 229-32(6 Jul 1970).

The two-center single-particle shell model is applied to the calculation of deformation energies and fission barriers of ^{236}U. The condition of volume conservation is used in three different ways and the results of the pure single-particle calculation are compared to those obtained with Strutinsky's renormalization method. (auth)

1747 ESTIMATE OF ISO-SPIN MIXING CORRECTION FACTORS TO COULOMB DISPLACEMENT ENERGIES. Ramavataram, S. (Univ., Laval, Quebec). Phys. Lett.; 32B: 239-42(6 Jul 1970).

R-matrix methods are applied to obtain estimate of the energy shift factors arising from isospin mixing for the 0^+ analog of ^{208}Pb ground state. The minimum value for the overall shift factor Δ is estimated to be −180 keV. (auth)

1748 PHOTOEXCITATION OF ISOBARIC ANALOGUE RESONANCES IN ^{208}Pb. Dover, C. B.; Huefner, J. (Univ., Heidelberg. Max-Planck-Institut fuer Kernphysik, Heidelberg). Phys. Lett.; 32B: 253-5(6 Jul 1970).

A peak observed in the ^{208}Pb(γ,p) reaction at E_γ = 24.9 MeV is interpreted as primarily the isobaric analog resonance (IAR) corresponding to the $(g_{9/2}h_{11/2}^{-1})_1$-configuration in ^{208}Tl. A radiative width of Γ_γ = 230 ± 200 eV is obtained from the data, compared to a calculated value of Γ_γ = 370 eV. (auth)

1749 TRANSITION DENSITY OF THE OCTUPOLE VIBRATION IN ^{208}Pb DETERMINED BY ELECTRON SCATTERING. Heisenberg, J. H.; Sick, I. (Stanford Univ., Calif.). Contract Nonr (67). Phys. Lett.; 32B: 249-52(6 Jul 1970).

Cross sections for the excitation by electrons of the 3^- level at 2.61 MeV in ^{208}Pb were obtained between 0.5 fm^{-1} and 2.8 fm^{-1} momentum transfer. The data at small momentum transfer can be understood in terms of the modified Tassie-model. The data at high momentum transfer, however, indicate that the transition density has a detailed structure. A transition density which fits the data is presented and compared to theoretical predictions. (auth)

1750 WEAK-COUPLING STATES IN ODD Zr ISOTOPES. Lieb, K. P.; Kent, J. J.; Hausmann, T.; Watson, C. E. (Univ. of Texas, Austin). Phys. Lett.; 32B: 273-6(6 Jul 1970).

Weak-coupling states in ^{91,93,95}Zr were investigated using the analog resonances technique. A consistent set of spectroscopic factors relative to those determined in a (d,p) experiment, was derived for a total of 24 states. (auth)

1751 GAMMA RADIATIONS IN THE ALPHA DECAY OF ^{231}Pa. Leang, Chin Fan (Centre National de la Recherche Scientifique, Orsay, France). J. Phys. (Paris); 31: 269-76(Apr 1970). (In French).

The gamma radiations following the α decay of ^{231}Pa were studied with high resolution Ge–Li detectors and by means of $\alpha-\gamma$ bidimensional coincidences on line with an IBM 360-50 computer. A level scheme of ^{227}Ac is proposed on the basis of the new data of the present work. (auth) (France)

1752 LEVELS IN THE DEFORMED EVEN-EVEN NUCLEI ^{156}Gd AND ^{160}Dy. McMillan, David Jon. Nashville; Vanderbilt Univ. (1969). 136p.

Thesis.

The experimental investigations of the radioactive decay of the nucleus ^{156}Tb to levels of the even–even nucleus ^{156}Gd include gamma-ray energy and relative intensity measurements, $\gamma-\gamma$ coincidence measurements, and internal-conversion electron studies. A high-resolution Ge(Li) spectrometer was used to measure the ^{156}Tb photon energies in favorable cases to within 0.1 keV, and photon intensities of the stronger transitions with an accuracy of three to five percent. In addition, many low-intensity gamma rays previously unobserved were identified with the ^{156}Tb decay. Gamma–gamma coincidence studies conducted with a Ge(Li)–NaI detector system provided information which supports the place-

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ment of eight additional levels into the ^{156}Tb decay scheme. The revised level scheme can account for 68 of the 88 observed transitions. Relative K-electron intensities of nineteen selected transitions from the ^{156}Tb decays were measured with a 50-cm iron, double-focusing beta-ray spectrometer. The ^{160}Tb decay to the even–even nucleus ^{160}Dy was investigated by using a Ge(Li) spectrometer for gamma-ray energy and intensity measurements, a Compton-suppression spectrometer to scan the high-energy gamma-ray spectrum for low-intensity transitions, and a Ge(Li)–NaI detector system for gamma–gamma coincidence studies. The results indicate that the Bohr–Mottelson model of the nucleus including first-order band mixing may not be adequate to describe the decay characteristics of levels of the beta- and gamma-vibrational bands in ^{156}Gd and of the gamma-vibrational band in ^{160}Dy. Discrepancies between experiment and theory for the relative B(E2) moments from the beta band of ^{156}Gd to the ground-state band could be resolved by assuming that the $\Delta I = 0$ transitions have large M1 admixtures but not by beta–gamma band mixing. Deviations are also observed for B(E2) moments from the gamma band to the ground-state band for both ^{156}Gd and ^{160}Dy. The deviations for the K = 2 levels, however, may be adequately explained by the inclusion of beta–gamma band mixing into the theory. (Diss. Abstr. Int., B)

1753 LOW ENERGY GAMMA EMISSION FROM ^{228}Ac. Maria, Henriette; Dalmasso, Josette; Ardisson, Gerard; Ythier, Christian (Univ., Nice). Compt. Rend., Ser. B; 271: 165-8 (15 Jul 1970). (In French).

Gamma ray emission from ^{228}Ra and its daughter products were studied for energies less than 1.55 MeV. The comparison of the gamma ray spectra of ^{228}Th + daughter and ^{226}Ra + daughter led to the identification of more than 95 γ rays due to ^{228}Ac; their energies and relative intensities were given. $(\gamma\gamma)$ coincidence measurements were made. Several energy levels of ^{228}Th occurring in the disintegration of ^{228}Pa were observed in the disintegration of ^{228}Ac. (auth) (France)

1754 HALF-LIFE DETERMINATIONS FOR $^{169\ 170\ 171}$Lu, ^{166}Yb, $^{165\ 166\ 167}$Tm, AND ^{160}Er. Karol, P. J. (Brookhaven National Lab., Upton, N. Y.). J. Inorg. Nucl. Chem.; 32: 2817-21 (Sep 1970).

Improved half-life data for the above nuclides were obtained from high resolution gamma spectra by analysis of γ-rays known to be specific for each nuclide. Values obtained were: ^{169}Lu = 34.06 ± 0.05 hr; ^{170}Lu = 2.02 ± 0.03 d; ^{171}Lu = 8.22 ± 0.03 d; ^{166}Yb = 56.7 ± 0.1 hr; ^{165}Tm = 30.06 ± 0.03 hr; ^{166}Tm = 7.70 ± 0.08 hr; ^{167}Tm = 9.25 ± 0.02 d; and ^{160}Er = 28.58 ± 0.09 hr. The statistical significance of the half-life uncertainty with regard to cross section calculations is discussed from a general standpoint. (UK)

1755 DETERMINATION OF PARTIAL TRANSITION PROBABILITIES OF THE 329 keV γ RAYS OF ^{140}Ce THROUGH AN ANGULAR CORRELATION METHOD. Letessier, J.; Cailliau, M.; Foucher, R.; Marcus, L. (Paris Univ., Orsay, France). J. Phys. (Paris); 31: 239-47(Apr 1970). (In French).

The angular correlation between the 329 keV and 487 keV γ rays of ^{140}Ce was measured, using sources of different physical structures. The E_2/M_1 multipole ratio for the 329 keV transition was determined; the transition probabilities obtained are compared to the values calculated using the independent particle and the quasiparticle models. (auth) (France)

1756 RADIOACTIVE DECAY SERIES ^{138}Nd → ^{138}Pr → ^{138}Ce. Hogan, J. J. (McGill Univ., Montreal). Can. J. Chem.; 48: 2151-7(15 Jul 1970).

Measurements of the energies and intensities of gamma rays associated with decay of ^{138}Nd, ^{138m}Pr, and ^{138g}Pr were performed using a Ge(Li) detector. The branching ratio to a previously unreported excited level of ^{138}Pr (328.1 keV) was measured, thus allowing for direct measurement of the decay of ^{138}Nd. Half-lives of 2.20 ± 0.07 and 5.04 ± 0.09 h were measured for ^{138m}Pr and ^{138}Nd respectively. Decay schemes for ^{138m}Pr → ^{138}Ce and for the decay chain ^{138}Nd → ^{138g}Pr → ^{138}Ce are proposed. (auth) (Canada)

1757 NaI(Tl)–Ge(Li) GAMMA–GAMMA DIRECTIONAL CORRELATION MEASUREMENTS OF M1–E2 MIXING IN THE DECAY OF VIBRATIONAL LEVELS IN ^{154}Gd. Whitlock, Lapsley Craig. Nashville; Vanderbilt Univ. (1969). 124p.

Thesis.

Measurements of branching ratios in the decay of beta vibrational states of ^{154}Gd, as well as of other nuclides, have shown inconsistencies in the values of Z_0, the parameter which measures the mixing of the beta and ground state bands. In the case of ^{154}Eu, it was observed that internally consistent Z_0 values could be obtained if the E2 intensity of the $2^+_\beta \rightarrow 2^+$, 692-keV transition were reduced approximately 50%. It has been suggested that the $2^+_\beta \rightarrow 2^+$ transition is not pure E2, but is admixed with M1, which is forbidden in the characterization of the 2^+_β as a quadrupole excitation. Similar results were obtained for the $4^+_\beta \rightarrow 4^+$, 677-keV transition. The present work describes the use of a NaI(Tl)–Ge(Li) directional correlation system in experimentally determining the multipolarities of these transitions. A pulse height analyzer was used to select pulses which correspond to the energy of a strong gamma ray in the NaI detector. A coincidence signal, generated when one of the selected pulses coincides with a pulse from the Ge(Li) detector, is used to gate a multichannel analyzer for storage of the coincidence spectra. The coincidence intensities of various gamma rays were determined as a function of angle, and the directional correlation coefficients calculated. The results obtained are: $A_2 = -0.141 \pm 0.022$ and $A_4 = 0.311 \pm 0.040$ for the $2^+_\beta \rightarrow 2^+ \rightarrow 0^+$, 692-123-keV cascade. These values yield a value for the multipolarity mixing parameter of $\delta = -(10)$, leading to the conclusion that M1 ≤ 2% of the total intensity. For the $4^+_\beta \rightarrow 4^+ \rightarrow 2^+$, 677-248-keV cascade, $A_2 = -0.168 \pm 0.020$ and $A_4 = 0.128 \pm 0.029$. From these results, $\delta = -(7)$ is obtained for the 677-keV, $4^+_\beta \rightarrow 4^+$ transition. The M1 component is then 1–4%. Directional correlation coefficients were also obtained for the following transitions which are in direct coincidence with the 123-keV transition: 873, 1005, 1274, 1496, and 1597 keV; and for the following transitions which are in direct coincidence with the 248-keV transition: 444, 625, 757, 881, 893, 1188, and 1246 keV. Some previously proposed spins and parities were established here for the first time. (Diss. Abstr. Int., B)

1758 MEASUREMENT OF ^{238}U FISSION TIME BY ~3 MeV NEUTRONS. Melikov, Yu. V.; Otstavnov, Yu. D.; Tulinov, A. F. (Moscow State Univ.). Yadern. Fiz.; 12: 50-2(Jul 1970). (In Russian).

The shadow effect is used to investigate the time parameters of the fission process of ^{238}U contained in the UO_2 monocrystal under the action of neutrons from d + d reaction. For two directions, along the neutron beam and normal to it, the pictures of shadows (fragmentograms) are obtained. The lifetime of the fissible nucleus is estimated to be $\tau \sim 10^{-16}$ sec. (auth)

1759 SPONTANEOUS FISSION OF SOME Fm ISOTOPES. Druin, V. A.; Skobelev, N. K.; Rud, V. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 12: 44-9(Jul 1970). (In Russian).

Spontaneous fission lifetimes of ^{246}Fm, ^{248}Fm and ^{250}Fm produced in reactions ^{233}U(^{18}O,5n)^{246}Fm, ^{238}U(^{18}O,6n)^{248}Fm and ^{238}U(^{18}O,6n) ^{250}Fm, were determined. The measured value of the spontaneous fission lifetime for ^{246}Fm, $T_{sf} \sim 20$ sec, is in agreement with the value obtained before and the value for ^{248}Fm, $T_{sf} \sim 60$ hr, is more than that from the published data. The fission lifetime for ^{250}Fm is about 10 yr. (auth)

1760 ANGULAR ANISOTROPY OF FISSION OF ^{237}Np AND ^{241}Am BY NEUTRONS. Shpak, D. L.; Fursov, B. I.; Smirenkin, G. N. Yadern. Fiz.; 12: 35-40(Jul 1970). (In Russian).

Angular distributions of fragments of ^{237}Np and ^{241}Am neutron fission in the 0.3 to 7.2 MeV energy region were measured in detail using glass detectors. The energy dependence of the parameters K_0^2 for investigated fissible odd-odd nuclei reveals a ladder structure. A possible explanation of this dependence by the effect of discrete variation of the number of excited quasiparticles is discussed. (auth)

1761 INVESTIGATIONS ON TERNARY PHOTOFISSION WITH TRACK RECORDERS OF DIFFERENT SENSITIVITY. Medveczky, L.; Somogyi, G. (Inst. of Nuclear Research, Debrecen, Hungary). Radiat. Eff.; 5: 51-9(Aug 1970).

The existence of the ternary photofission of ^{232}Th, ^{238}U, and ^{239}Pu induced with the bremsstrahlung of a 27.5-MeV electron beam has been looked for simultaneously with track detectors of different thresholds. In sandwiches prepared from both muscovite mica and plastic (Melinex O), altogether about 1.5 million binary fission events have been scanned. Data are given for the frequency of (1) three-prong events, (2) two-prong events with a space angle smaller than 180°, and (3) recoil events produced by the fission fragment scattered on ^{39}K and ^{16}O occurring in the material of the mica and plastic detectors, respectively. In the case of (1) and (2) range and angular distributions are also presented. Results obtained in mica and plastic are compared. A background consisting of short tracks has been discovered in plastic sandwiches containing ^{239}Pu. The track density shows a correlation with the concentration of target nuclei and the storage time before etching. A possible origin of this track is discussed. (auth)

1762 ELECTRON CONVERSION SPECTRUM FROM ^{204}Po DECAY BY ELECTRON CAPTURE. Kusch, W.; Droste, Ch.; Morek, T.; Chojnacki, S.; Chuburkova, I. I. (Joint Inst. for

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Nuclear Research, Dubna, USSR). Yadern. Fiz.; 12: 3-8(Jul 1970). (In Russian).

Electron conversion spectra from ^{204}Po electron-capture decay were measured by means of an ironless magnetic toroidal spectrometer. Multipolarities and total transition intensities are discussed on the basis of the results obtained. (auth)

Nuclear Theory

Refer also to abstracts 1459, 1568, 1570, 1579, 1589, and 1736.

1763 (COO-427-105) THEORETICAL PHYSICS IN THE FIELD OF INTERACTION OF PHOTONS AND PARTICLES WITH NUCLEI. Technical Progress Report, November 1, 1969-October 31, 1970. (Notre Dame Univ., Ind.). 15 Jul 1970. Contract AT(11-1)-427. 19p. Dep. CFSTI.

Research progress at the University of Notre Dame from Nov. 1, 1969 to Oct. 31, 1970 in theoretical studies of the interactions of photons and particles with nuclei is reported. (J.W.R.)

1764 (ORNL-TM-3119) EVAP-4: ANOTHER MODIFICATION OF A CODE TO CALCULATE PARTICLE EVAPORATION FROM EXCITED COMPOUND NUCLEI. Guthrie, Miriam P. (Oak Ridge National Lab., Tenn.). 10 Sep 1970. Contract W-7405-eng-26. 17p. Dep. CFSTI.

EVAP-4 is a Monte Carlo computer program that calculates the types, multiplicities, and energy distributions of particles evaporated from excited compound nuclei. It is identical to its predecessor, EVAP-3, except that an "improved-termination" feature has been added. This permits evaporation to continue as long as energetically possible by removing a pairing-energy correction to the excitation energy of the compound nuclues after the initial rounds of evaporation have stopped. EVAP-4 is written in FORTRAN IV for the IBM-360 computer. The input card and printed output for a sample case are shown. (auth)

1765 RADIATIVE DECAY-RATE RELATION FOR ISOBARIC MULTIPLETS. Ram, Michael (State Univ. of New York, Buffalo). Phys. Rev. Lett.; 25: 391-3(10 Aug 1970).

The relation $\Gamma_\gamma(\xi,T,T_z) = a'(\xi,T) + b'(\xi,T)T_z + c'(\xi,T)T_z^2$ for the total radiative decay rates of isospin multiplet members is derived. (auth)

1766 EXCITATION ENERGY DEPENDENCE OF SHELL EFFECTS ON NUCLEAR LEVEL DENSITIES AND FISSION FRAGMENT ANISOTROPIES. Ramamurthy, V. S.; Kapoor, S. S.; Kataria, S. K. (Bhabha Atomic Research Centre, Bombay). Phys. Rev. Lett.; 25: 386-90(10 Aug 1970).

It is shown that the nuclear shell effects on the level density disappear even at medium excitation energies of the order of 40 MeV. Fission-fragment anisotropy data for actinide nuclei having double-humped fission barriers are shown to contain evidence for this effect. The implication of this effect on the production of superheavy nuclei is pointed out. (auth)

1767 CONCERNING EFFECTS OF STRUCTURE OF NUCLEAR SURFACES IN NEUTRON SCATTERING AT SMALL ANGLES. Potupa, A. S.; Tret'yakov, V. N. Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 1, 87-94(1970). (In Russian).

The anomalous anisotropy in small angle neutron scattering on heavy nuclei is explained by a model which considers the effect of surface properties. This contribution is approximated by a triangular diagram. Semiquantitative agreement with experiment was found. (J.W.R.)

1768 MICROSCOPIC PREDICTIONS FOR THE ISOTOPIC DEPENDENCE OF STRONG ABSORPTION RADII. Jackson, Daphne F. (Univ. of Surrey, Eng. Univ. of Maryland, College Park). Phys. Lett.; 32B: 233-5(6 Jul 1970).

It is shown that a microscopic model for elastic α-particle scattering can reproduce the observed isotopic dependence of the strong absorption radii of medium mass nuclei. (auth)

1769 SINGLE PARTICLE STRENGTH IN THE CONTINUUM. McKellar, B. H. J. (Univ. of Sydney). Phys. Lett.; 32B: 246-8 (6 Jul 1970).

The coupling to inelastic channels is shown to transfer about 10% of the single particle strength to inelastic continuum states, where it is difficult to observe it directly. However, it is pointed out that such a depletion of the single particle strength is consistent with recent analyses of stripping reactions on doubly magic nuclei. (auth)

1770 EMPIRICAL VALIDITY OF PHENOMENOLOGICAL RENORMALIZED NUCLEAR BRUECKNER-HARTREE-FOCK THEORY. Becker, R. L. (Oak Ridge National Lab., Tenn.). Phys. Lett.; 32B: 263-6(6 Jul 1970).

Experimental nuclear binding energies and single nucleon removal energies can be related to good approximation by modified Hartree-Fock equations incorporating depletions of normally occupied states. The average depletions required are in close agreement with those calculated from realistic interactions. (auth)

1771 INTERACTION BETWEEN 0p-0h AND 1p-1h STATES IN 0^+ CALCULATIONS WITH NON HARTREE-FOCK BASES. Mavromatis, H. A. (Univ. of Sussex, Brighton, Eng.). Phys. Lett.; 32B: 256-8(6 Jul 1970).

It is shown that it is sometimes misleading to pretend one has self-consistency when working with a basis other than Hartree-Fock. (auth)

1772 PROJECTION OPERATORS IN NUCLEAR STRUCTURE CALCULATIONS. MacDonald, N. (Univ. of Glasgow). Advan. Phys.; 19: 371-401(May 1970).

Projection operators are an important tool in nuclear structure theory, because in many circumstances it is useful to construct wave-functions Ψ which are not eigenfunctions of some operator Λ, although it is apparent that the physical states must be eigenstates of that operator. Thus Ψ is first constructed and then projected onto eigenfunctions of Λ. The cases of angular momentum, isospin, center of mass energy, particle number and antisymmetry are discussed. The integral projection operator, an expansion in shift operators, the product operator of Löwdin and another product operator (the cosine product) are described. Certain methods which appear in the literature are seen to be equivalent to one or the other of these. Factors that influence the choice of an appropriate method are considered. Projection occurs frequently in the context of a variational method (such as Hartree-Fock or BCS). The question of projection before or after variation is considered. (auth) (UK)

1773 ANOMALOUS NEUTRON SCATTERING. Lebedeva, N. S.; Morozov, V. M. At. Energ. (USSR); 28: 310-16(Apr 1970). (In Russian).

With the use of the concept of a potential in explaining the interaction of nucleons with nuclei it is assumed that the nuclear potential consists of a number of components. In most cases, elastic neutron scattering is satisfactorily described by assuming the existence of a potential of short-range nuclear forces, as in the optical model of elastic neutron scattering. However with elastic neutron scattering by nuclei at small angles (a few degrees), the non-nuclear components of the total potential which are caused by relatively small, but long-range forces (for example, of an electromagnetic nature) can play an essential role, since the neutron is not a completely neutral particle. The region of small-angle neutron scattering which corresponds to small changes in the momentum of the scattered particle is also suitable for the search of other weak forces of the interaction of neutrons with nuclei. Schwinger made the first estimates of the simplest, "non-nuclear" mechanism of scattering which occurred as a result of the interaction of the magnetic moment of a fast neutron with the Coulomb field of the nucleus. Polarization of neutrons takes place in the case of Schwinger scattering. After reviewing the work in this field up to the present it is concluded that there are no other scattering "anomalies" that cannot be explained by the short-range nuclear and Schwinger potentials. (TTT)

1774 SOLUTION OF THE BETHE-GOLDSTONE EQUATION IN A SHELL MODEL BASIS. Truelove, J. S.; Nicholls, I. R. (Sydney Univ.). Aust. J. Phys.; 23: 231-8(Jun 1970).

It has been shown by Butler et al. (1970) that a useful approximation to the Bethe-Goldstone wavefunction can be constructed from eigenfunctions of the free two-nucleon system. It is shown in this paper how the Bethe-Goldstone equation may be solved to any desired accuracy in terms of these same functions. The solution is obtained using an iterative procedure with the approximate wavefunctions of Butler et al. as a starting point. The Pauli operator is treated exactly: diagonal in the space of two-particle shell model states. To illustrate the method the energy levels of the valence particles in ^{18}O and ^{18}F have been calculated using pure harmonic oscillator intermediate states and the Hamada-Johnston potential. The results are significantly different from those of Mercier, Baranger, and McCarthy (1969) who used an approximate Pauli operator. (auth) (Australia)

1775 EFFECTIVE NUCLEON-NUCLEON INTERACTION FOR USE IN NUCLEAR HARTREE-FOCK CALCULATIONS. Nestor, Charles William Jr. Nashville; Vanderbilt Univ. (1969). 155p.

Thesis.

The use of the Hartree–Fock approximation for the calculation of the properties of finite nuclei requires a nucleon–nucleon interaction for which corrections to the Hartree–Fock approximation are small, and this requirement eliminates the "hard-core" potentials. Many different kinds of effective potential have been proposed without hard-core terms, and among these, nonlocal potentials have been studied extensively. It is the purpose of this thesis to explore certain properties of a particular type of nonlocal potential, one which includes a quadratic velocity-dependent repulsion. The primary emphasis in this work was on the determination of the parameters defining the effective interaction so that the values of the energy and density of infinite nuclear matter, as calculated in the Hartree–Fock approximation, would match the experimental values of these quantities. The reason for this emphasis, rather than the more conventional one of fitting two-body scattering data, is the observation that two potentials of very different form and predicted two-body phase shifts gave almost identical shell-model wave functions and energy levels in selected finite nuclei when the parameters were adjusted to match the energy and density of nuclear matter. It is desirable to find an effective interaction which does as little violence as possible to the two-body data, and a chapter of this thesis is devoted to the two-body problem. However, for the potentials studied to date, the two-body phase shifts are not fitted very well, particularly at high energies. The requirement of fitting the energy and density of nuclear matter has been satisfied, and some nuclear Hartree–Fock calculations with these potentials have given good agreement with experiment for light spherical nuclei, so the misfit to the high-energy phase shifts does not appear to be a serious disadvantage. The predicted properties of heavier spherical nuclei, calculated in the Hartree–Fock approximation with the potentials reported in this thesis, do not agree with experiment. Further work is needed to resolve this discrepancy, which appears to be due to different sources than does the misfit to the high-energy phase shifts. (Diss. Abstr. Int., B)

1776 WEAK INTERACTIONS IN NUCLEAR PHYSICS. **Primakoff, H. (Univ. of Pennsylvania, Philadelphia). Ergeb. Exakten Naturwiss.; 53: 6-28(1970).**

The topics discussed include meson exchange and bound nucleon-isobar effects in nuclear beta decay and muon capture, nuclear two-neutrino and no-neutrino double-beta decay, second-class hadronic weak currents in nuclei, the Goldberger–Treiman relation, the Adler–Weisberger sum rule, and the Weinberg–Tomozawa formula. A brief treatment of the problem of nonleptonic weak processes in nuclei is also given. (J.W.R.)

1777 DEPENDENCE OF THE VALUE OF ANISOTROPY OF THE FISSION NEUTRON EMISSION ON THE TOTAL KINETIC ENERGY OF FRAGMENTS. **Blinov, M. V.; Kazarinov, N. M.; Krisyuk, I. T.; Protopopov, A. N. (Radium Inst., Leningrad). Yadern. Fiz.; 12: 41-3(Jul 1970). (In Russian).**

The dependence of the anisotropy of fission neutron emission on the total kinetic energy E_k was measured experimentally and calculated using the model of neutron evaporation from the accelerated fragments. At small E_k the experimental and calculated values of anisotropy are close while at large E_k they essentially diverge, which may be due to the presence of a "non-evaporating" component. (auth)

1778 ANALYSIS OF 3N PARAMETERS WITH N–N FORCES. **Shrenk, George L. (Univ. of Pennsylvania, Philadelphia); Gupta, V. K.; Mitra, A. N. Phys. Rev., C; 1: 895-903(Mar 1970).**

This investigation has a twofold objective, (a) to examine in some detail the effects of various refinements in the input forces on the binding energy (BE) of the triton and the doublet neutron-deuteron scattering length ($a_{\frac{1}{2}}$), and (b) to compare the effects of shape variations in the potentials on the evaluation of the same quantities. For this purpose, the BE and $a_{\frac{1}{2}}$ with the inclusion of tensor and core effects are calculated individually and collectively and a comprehensive comparison of these results is given along with those obtained in earlier investigations by various authors. For the second objective, the results for an entirely different shape of the separable potentials (viz., form factors of the type $\sqrt{Q_0}$ which fulfill certain analyticity requirements on the potentials) are presented, and these predictions are compared with those based on potentials proposed by Yamaguchi and Yukawa. The effects of the shape variation on the results found from the comparison of these potentials, which agree only approximately on the energy shell, persist even with higher-ranked potentials which agree much more closely on the energy shell as a result of the inclusion of repulsive-core terms. The limitations that the effects of shape variations imply on the reliability of three-body calculations with input two-body forces are discussed. (auth)

1779 MIXED-CONFIGURATION SHELL-MODEL CALCULATIONS FOR NUCLEI WITH N = 28, 20 < Z ≤ 28. **Lips, K.; McEllistrem, M. T. (Univ. of Kentucky, Lexington). Phys. Rev., C; 1: 1009-24(Mar 1970).**

Level energies, γ-ray transition rates, and proton spectroscopic factors are calculated for the nuclei with N = 28 and 20 < Z ≤ 28 from simple mixed-configuration shell models. First, the effective-interaction method is used to calculate wave functions in which the pure $(1f_{\frac{7}{2}}^{n})$ configuration and the $(1f_{\frac{7}{2}}^{n-1}2p_{\frac{3}{2}})$ configuration are included. The results are compared with experimental values for 43 levels. The calculated and measured energies and spectroscopic factors agree well, but M1 transition rates are too slow. The model is then extended to include the configuration $(1f_{\frac{7}{2}}^{n-1}1f_{\frac{5}{2}})$. The wave functions are recalculated using additional two-body matrix elements calculated with a modified surface δ interaction (MSDI) fitted to the effective interactions of the first calculation. The expanded model provides a good fit to energies, spectroscopic factors, and transition rates. For comparison, the calculation is repeated using the reaction matrix elements of Kuo and Brown. The results are less satisfactory than those with the MSDI. (auth)

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REACTOR TECHNOLOGY

Commercial Power Reactors

Refer also to abstracts 319 and 328.

1780 (DOCKET-50003-58) INDIAN POINT STATION, UNIT NO. 1. Examination of the 24-Inch Line. (Battelle Memorial Inst., Columbus, Ohio). 1 Oct 1970. 49p. Dep. NTIS.

For Consolidated Edison Co. of New York, Inc., New York.

A 12-inch circular segment of the 24-inch line around the 4-inch makeup water inlet in the Indian Point Unit 1 Reactor was examined for cracks, alloy chemistry, and mechanical properties. Except for slightly high phosphorus (0.042 percent total), the Type 304 stainless steel of the hollow forged pipe met the specifications of ASTM A-376, accounting for the tolerances permitted in ASTM A-480. The longitudinal and transverse tensile properties of the pipe surpassed the minimums specified in ASTM A-376, and flat samples machined from the pipe passed 1T-radius bend tests. Numerous cracks to a depth of up to 0.25 inch were found on the inner surface of the 24-inch line adjacent to and downstream from the 4-inch hole. Some of these cracks also extended into the 4-inch hole and propagated in the direction of the 4-inch hole (normal to the 24-inch surface). Two cracks were found on the 4-inch wall about 0.5 inch below the lip and not connected to any cracks on the 24-inch surface. The cracks were transgranular and nonbranching. Scanning-electron-microscope examinations near the tips of cracks penetrating into the 24- and 4-inch surfaces revealed fatigue-like striations that numbered 75 to 100 per 0.001 inch. It is postulated that the cracks were the result of fatigue produced by thermal shock from the cold makeup water added during reactor operation and that the cracks in the 24-inch line propagated concurrently with those in the thermal sleeve examined in a previous study. X-ray-fluorescence and electron-microprobe analysis of corrosion products from the 24-inch surface and crack fracture faces revealed no crack-producing corrodents. This evidence, plus the nature of the cracks, indicates that stress corrosion was not the cause of the cracking. (auth)

1781 (DOCKET-50029-138) YANKEE NUCLEAR POWER STATION. License No. DPR-3; Technical Specifications Change No. 91. (Division of Reactor Licensing (AEC), Washington, D. C.). 26 Oct 1970. 2p. Dep. NTIS.

The Technical Specifications change to allow the installation of additional on-site sources of emergency electrical power is authorized. (H.D.R.)

1782 (DOCKET-50029-139) YANKEE NUCLEAR POWER STATION. License No. DPR-3; Technical Specifications Proposed Change No. 95, Suppl. 4. (Yankee Atomic Electric Co., Westboro, Mass.). 29 Oct 1970. 3p. Dep. NTIS.

A revised diagram of the spilled water recirculation system to show a flow path change is presented. (H.D.R.)

1783 (DOCKET-50146-66) SAXTON REACTOR. License No. DPR-4. Information Requested Concerning Furnace Sensitized Stainless Steel Components. (Saxton Nuclear Experimental Corp., Pa.). 4 Nov 1970. 10p. Dep. NTIS.

1784 (DOCKET-50219-113) OYSTER CREEK NUCLEAR POWER PLANT, UNIT NO. 1. Additional Information on Sensitized Stainless Steel. (Jersey Central Power and Light Co., Morristown, N. J.). 30 Oct 1970. 2p. Dep. NTIS.

1785 (DOCKET-50250-33) TURKEY POINT PLANT, UNITS NO. 3 AND NO. 4. Additional Information Requested on FSAR. Preliminary Safety Analysis Report, [Amendment 26], Suppl. 26. (Florida Power and Light Co.). 23 Oct 1970. 33p. (DOCKET-50251-31). Dep. NTIS.

1786 (DOCKET-50254-21) QUAD-CITIES STATION, UNIT 1. Reactor Pressure Vessel Fire, September 27, 1970. (Commonwealth Edison Co., Chicago, Ill.). 27 Oct 1970. 7p. Dep. NTIS.

1787 (RD/B/N-1724) FINE STRUCTURE, HYPERFINE WEIGHTS, AND REACTIVITY WORTHS IN A HARTLEPOOL A.G.R. CLUSTER. Nunn, D. L. (Central Electric Generating Board, Berkeley (England). Berkeley Nuclear Labs.). May 1970. 36p. Dep. NTIS (U. S. Sales Only).

The fine structure, the hyperfine weights, and the reactivity in a Hartlepool A. G. R. fuel cluster at operating temperatures, with and without burnable poisons present, are calculated by the PRIZE theoretical method for two fuel enrichments and a comparison is made with other theoretical methods, i.e., TWODIG, CALIF, ARGOSY and WIMS. (auth) (UK)

1788 STUDY OF THE DYNAMICAL BEHAVIOR OF THE RHEINSBERG NUCLEAR POWER PLANT DURING TOTAL FAILURE OF VOLTAGE. Rosenkranz, H. (VEB Kombinat Kraftwerksanlagenbau, Berlin). Kernenergie; 13: 254-60(Aug 1970). (In German).

The case of average "total failure of voltage" is one of the most dangerous possible in the Rheinsberg nuclear power plant. Kinetic run down of the main recirculating pumps in connection with their further operation at 25 percent of nominal number of revolutions by means of emergency batteries cannot warrant emergency cooling of the reactor. Starting from analytical and experimental studies, emergency cooling of the reactor core is shown to be warranted by utilizing vapour run down and kinetic run down of the turbogenerator. (auth)

1789 CARRY-OVER OF ZINC CORROSION PRODUCTS FROM BOILING WATER TO STEAM AND DISTRIBUTION OF ^{65}Zn THROUGH BWR VK-50 CYCLE. Martynova, O. I.; Nazarov, A. I.; Chechetkin, Yu. V.; Kobzar, I. G.; Samoilov, Yu. F.; Petrova, T. I. At. Energ. (USSR); 29: 82-6(Aug 1970). (In Russian).

Values of distribution coefficients of Zn corrosion products at 180 and 100 atm are given. The data are compared with experimental results, obtained in the BWR VK-50 and measured by means of ^{65}Zn. The distribution coefficients of Zn corrosion products as well as the half-life of ^{65}Zn being high, it can be supposed that the main part of the steam-condensate cycle long-lived activity is due ^{65}Zn. The obtained values on activity of various steam-condensate cycle details, prove the supposition. Methods most effective in reducing the ^{65}Zn activity are: steam washing or replacing the pre-heaters and turbine condenser brass-alloys by some other alloys. (auth)

1790 FOUNDATIONS FOR SALEM NUCLEAR GENERATING STATION. Kehnemuyi, Muzaffer (Public Service Electric and Gas Co., Newark, N. J.). Civil Eng. (N. Y.); 40: No. 5, 52-5 (May 1970).

The foundations at Salem Nuclear Generating Station are unique in that both the nuclear and conventional buildings of the plant are supported by the same soil stratum, but by different foundation systems. In order to transmit the shears induced by earthquake or tornado, a lean concrete fill foundation averaging 25 ft in depth was used under the nuclear (Class I) structures, while concrete filled pipe piles were used under the conventional buildings (Class III). The use of different types of foundations systems resulted in a design that satisfied the AEC requirements for nuclear structures, and at the same time resulted in an economical system for supporting the conventional structures—and this at a site where good bearing stratum is 70 ft and bedrock 1,800 ft below grade. (auth)

1791 NUCLEAR ENERGY IN THE UNITED STATES. Leclercq, Jean. At. Strom; 16: 118-20(Aug 1970). (In German).

After the boom in orders in the years 1966 to 1968 there was a decline in the number of orders placed for new nuclear power stations. A judgement of the position of nuclear energy in the United States is based on impressions and information gained in conversations with representatives of electricity supply undertakings, private research organisations, the Atomic Energy Commission, and the Federal Power Commission. (auth)

1792 CONSTRUCTION OF THE REACTOR HALL SHAFT FOUNDATIONS OF HARTLEPOOL NUCLEAR POWER STATION. Greenwood, I. J. Proc. Inst. Civil Eng. (London); 47: 145-56 (Oct 1970).

The geological cross section in the area of construction is given. The forty shafts, seventeen for each reactor arranged in two concentric circles and six to support the shielded facilities, were each 7 ft 7 in. in diameter. Excavation, which was effected by mud displacement drilling to rockhead and subsequent excavation of a bell shaped foot within the rock by hand, was expensive. Specifications for the shaft filling and the permanent casing are listed. Full details of the excavation and concreting of the shafts are given. (auth) (UK)

1793 COOLANT ACTIVITY EXPERIENCE AT CONNECTICUT YANKEE. Graves, R. H. (Connecticut Yankee Atomic Power Co., East Hampton, Conn.). Nucl. News; 13: No. 11, 66-7(Nov 1970).

The problem of large concentrations of ^{58}Co in the coolant is

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analyzed. Design modifications required to handle the coolant activity are described. (D.C.C.)

Operation and Economics

Refer also to abstract 668.

1794 (DOCKET-50016-86) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. [Operations] Report, July 1970. (Power Reactor Development Co., Detroit, Mich.). 30 Oct 1970. 15p. (PRDC-EF-83). Dep. NTIS.

1795 (DOCKET-50146-65) SAXTON REACTOR. Operating Experience Report, March 1-August 31, 1970. (Saxton Nuclear Experimental Corp., Pa.). 26 Oct 1970. 44p. Dep. NTIS.

1796 (DOCKET-50213-81) CONNECTICUT YANKEE ATOMIC POWER PLANT. Malfunction of Pressurizer Level Instrumentation. (Connecticut Yankee Atomic Power Co., Westboro, Mass.). 4 Nov 1970. 6p. Dep. NTIS.

1797 (DOCKET-50219-114) OYSTER CREEK NUCLEAR POWER PLANT, UNIT NO. 1. Abnormal Occurrence Report: Failure of the Torus Oxygen Sample Line Isolation Valve. (Jersey Central Power and Light Co., Morristown, N. J.). 2 Nov 1970. 2p. Dep. NTIS.

1798 (DOCKET-50237-82) DRESDEN NUCLEAR POWER STATION, UNIT 2. Unplanned Release of Radioactive Waste. (Commonwealth Edison Co., Chicago, Ill.). 22 Oct 1970. 2p. Dep. NTIS.

1799 (DOCKET-50237-84) DRESDEN NUCLEAR POWER STATION, UNIT 2. Battery Charger Inoperable. (Commonwealth Edison Co., Chicago, Ill.). 14 Oct 1970. 2p. Dep. NTIS.

1800 (DOCKET-50244-52) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT NO. 1. Malfunction of Containment Sump Valve. (Rochester Gas and Electric Corp., N. Y.). 23 Oct 1970. 2p. Dep. NTIS.

1801 (DOCKET-50261-45) H. B. ROBINSON UNIT NO. 2. Temporary Loss of Power. (Carolina Power and Light Co., Raleigh, N. C.). 30 Oct 1970. 5p. Dep. NTIS.

1802 (DOCKET-50266-30) POINT BEACH NUCLEAR PLANT, UNIT 1. Report of Abnormal Occurrence. (Wisconsin Electric Power Co., Milwaukee). 22 Oct 1970. 3p. Dep. NTIS.

Safety analysis of an accidental trip of emergency systems during the installation of a control board for a room ventilation fan is presented. (D.C.C.)

1803 (DOCKET-50269-27) OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3. Preliminary Safety Analysis Report, Amendment 22. (Duke Power Co., Charlotte, N. C.). 22 Oct 1970. 5p. (DOCKET-50270-27; DOCKET-50287-24). Dep. NTIS.

1804 (TID-25558) GUNDREMMINGEN NUCLEAR POWER PLANT. Monthly Report, August 1970. (Kernkraftwerk RWE-Bayernwerk G.m.b.H., Gundremmingen (West Germany)). 16 Sep 1970. 42p. (In German). Dep. NTIS.

The plant was operated at full load throughout the month except for a small number of reductions ordered by the load dispatcher. Secondary steam line closure occurred owing to an automatic system malfunction, causing a brief dip in power output. Preliminaries were carried out for the dispatch of used elements and rods. Reactor water and exhaust gas activity remained constant at low levels. (auth)

1805 ACHARYA JAGADISH CHANDRA BOSE MEMORIAL LECTURE: FUTURE ON NUCLEAR POWER IN INDIA. Sethna, H. N. (Bhabha Atomic Research Centre, Bombay). Sci. Cult. (Calcutta); 36: 5-16(Jan 1970).

The development of nuclear power plants and process heat reactors for agro-industrial complexes is described. The economic considerations for nuclear power development in India are analyzed. (D.C.C.)

1806 REVIEW OF THE UK NUCLEAR POWER PROGRAMME. 2. Starkey, J. P.; Banget, B. A. Nucl. Energy; 11: 159-64(Sep-Oct 1970).

The cost of capital to the government is examined. The criteria on which this discount rate, which is to be applied to the costs and benefits of the nuclear energy program, are assessed and discussed. The chosen figure is 12%. The likely generating costs in 1980 are evaluated. It is thought reasonable that the capital costs of nuclear stations built around 1980 will lie in the range £45 to £60/kW installed while the operating cost should be about 0.1 d/kWh. The optimal mix of energy sources required over the period to 1995 is discussed. It is considered that there are three objectives for research which include: a gas cooled design decisively cheaper than the third AGR, the F.B.R. developed into a commerical power technology, and a satisfactory competitor for markets demanding smaller units. The costs and benefits are assessed. (UK)

1807 COMPETITION BETWEEN URANIUM AND PETROLEUM. Desprairies, Pierre (Societe ELF-ERAP, Paris). Rev. Fr. Energ; 223: 465-73(Jul-Aug 1970). (In French).

Competition between U and petroleum in the industrial field is determined by the cost of the electric kilowatt. Advantages and disadvantages of nuclear power plants are discussed. (auth) (France)

1808 OPERATIONAL EXPERIENCE WITH NUCLEAR POWER STATIONS IN THE GERMAN FEDERAL REPUBLIC. At. Strom; 16: 129-44(Sep 1970). (In German).

The Committee "Exchange of Operational Experience" (ABE Committee) of the German Atom Forum presents the operations report for the year 1969, so as to make the experience which has been gathered available to a wider circle of people interested in the technical development of nuclear power stations. (auth)

Safety and Siting

Refer also to abstracts 1914 and 1951.

1809 (BNWL-SA-2737) IMPROVED METHODS FOR PLANNING OF THERMAL DISCHARGES BEFORE SITE ACQUISITION. Jaske, R. T. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Dec 1969. Contract AT(45-1)-1830. 17p. (CONF-691102-28). Dep. NTIS.

From 17th Conference on Remote Systems Technology, San Francisco, Calif.

COLHEAT, a deterministic stream temperature prediction system, is described. This system describes the thermal regimen of a river or estuary and permits advance estimates of thermal effects of impoundments, single thermal plants, or an extended series of thermal and hydro installations with overlapping effects on a single or regionally combined watershed. The basic operation is a two step process: multiple shell or zonal transport system with adjustable allocation of inter and intra shell transport. In its present form, the model receives inputs on a mixed basis into the assigned shells without attempting to fully model the transition from the point of discharge to the fully mixed condition. Nominally, it is a one-dimensional model. 9 references. (auth)

1810 (CONF-700408-4) DISCUSSION OF PROPOSED AMENDMENTS TO AEC REGULATIONS ON RADIOACTIVE EFFLUENTS FROM LIGHT WATER COOLED NUCLEAR POWER REACTORS. Rogers, Lester (Division of Radiation Protection Standards (AEC), Washington, D. C.). [1970]. 11p. Dep. NTIS.

From 2nd Conference on Radiation and Man's Environment, Buck Hill Falls, Pa.

Proposed amendments to the AEC regulations would express the intent that, consistent with Federal Radiation Council guides, all AEC licensees should make every reasonable effort to maintain releases of radioactive effluents to the environment as far below the limits specified as practicable. The effects of the proposed amendments on nuclear power plant design and operating requirements are discussed. (H.D.R.)

1811 (DOCKET-1155-83) LA CROSSE BOILING WATER REACTOR. Nuclear Instrumentation Automatic Gain Control System. (Allis-Chalmers Mfg. Co., Bethesda, Md. Atomic Energy Div.). Oct 1970. Contract AT(11-1)-850. 92p. (ACNP-70503). Dep. NTIS.

1812 (DOCKET-50003-57) INDIAN POINT STATION, UNIT NO. 1. Report on Leakage Rate Test of Containment Structure (Errata). (Consolidated Edison Co. of New York, Inc., New York). 21 Oct 1970. 4p. Dep. NTIS.

1813 (DOCKET-50016-84) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. Establishment of a Management Control System for Work Required by Technical Specifications. (Power Reactor Development Co., Detroit, Mich.). 23 Oct 1970. 2p. Dep. NTIS.

1814 (DOCKET-50016-85) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. Amended Request for Authorization of Change No. 15 in the Technical Specifications. (Power Reactor Development Co., Detroit, Mich.). 19 Oct 1970. 26p. Dep. NTIS.

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Revised operating limits for the fuel transport facility are presented. The operating limits concern the handling of irradiated fuel assemblies. (D.C.C.)

1815 (DOCKET-50029-137) YANKEE NUCLEAR POWER STATION. License No. DPR-3; Technical Specifications Proposed Change No. 95, Suppl. 3. (Yankee Atomic Electric Co., Westboro, Mass.). 23 Oct 1970. 3p. Dep. NTIS.

Surveillance requirements for the recirculation system are described. (D.C.C.)

1816 (DOCKET-50133-41) HUMBOLDT BAY POWER PLANT, UNIT NO. 3. Request for Amendment to License No. DPR-7. (Pacific Gas and Electric Co., San Francisco, Calif.). 21 Oct 1970. 3p. Dep. NTIS.

Revised limits on quantities of nuclear materials to be utilized and stored at the reactor are presented. (D.C.C.)

1817 (DOCKET-50146-64) SAXTON REACTOR. License No. DPR-4; Technical Specifications Change Request No. 40. (Saxton Nuclear Experimental Corp., Pa.). 28 Oct 1970. 5p. Dep. NTIS.

Redesigned fuel assembly wrapper cans for Core 3 are described. The wrapper cans are designed to prevent deformation and increase core life. (D.C.C.)

1818 (DOCKET-50155-51) BIG ROCK POINT NUCLEAR PLANT. Design Modification Necessary for Installation of Control Rod Drive Support Structure. (Consumers Power Co., Jackson, Mich.). 30 Oct 1970. 4p. Dep. NTIS.

1819 (DOCKET-50155-52) BIG ROCK POINT NUCLEAR PLANT. Comments on Uniform Monitoring, Recording, and Reporting of Radionuclide Releases from Nuclear Power Facilities. (Consumers Power Co., Jackson, Mich.). 6 Nov 1970. 2p. Dep. NTIS.

1820 (DOCKET-50206-93) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Complete Information on Sensitized Stainless Steel Materials. (Southern California Edison Co., Los Angeles). 30 Oct 1970. 10p. Dep. NTIS.

1821 (DOCKET-50213-79) CONNECTICUT YANKEE ATOMIC POWER PLANT. Preliminary Safety Analysis Report, Amendment 20. (Connecticut Yankee Atomic Power Co., Hartford). 23 Oct 1970. 165p. Dep. NTIS.

Revised design parameters of the Connecticut Yankee Power Reactor are presented. Included also are additional data on the reactor requested by the Division of Reactor Licensing. (J.M.J.)

1822 (DOCKET-50213-80) CONNECTICUT YANKEE ATOMIC POWER PLANT. Effect of Oil and Extinguisher Material on Reactor-Coolant Piping and Pump at Connecticut-Yankee. Technical Report E-1344. (Teledyne Materials Research Co., Waltham, Mass.). 22 Oct 1970. 25p. Dep. NTIS.

For Connecticut Yankee Atomic Power Co., Westboro, Mass.

1823 (DOCKET-50220-50) NINE MILE POINT NUCLEAR STATION. Petition Requesting Amendment of License, Amendment 2. Technical Supplement to Petition to Increase Power Level, Second Addendum. (Niagara Mohawk Power Corp., Syracuse, N. Y.). 29 Oct 1970. 25p. Dep. NTIS.

1824 (DOCKET-50220-51) NINE MILE POINT NUCLEAR STATION. Primary Containment Integrated Leak Test. (Niagara Mohawk Power Corp., Syracuse, N. Y.). 3 Nov 1970. 8p. Dep. NTIS.

1825 (DOCKET-50237-81) DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3. Welding Procedures for Primary System Piping. (Commonwealth Edison Co., Chicago, Ill.). 16 Oct 1970. 70p. (DOCKET-50249-42). Dep. NTIS.

1826 (DOCKET-50237-83) DRESDEN NUCLEAR POWER STATION, UNIT 2. License No. DPR-19; Technical Specifications Change No. 6. (Division of Reactor Licensing (AEC), Washington, D. C.). 20 Oct 1970. 5p. Dep. NTIS.

Containment monitoring instrumentation testing is described. In-service inspection procedures for furnace sensitized stainless steel core components are presented. Operation limits for primary containment isolation valves are listed. (D.C.C.)

1827 (DOCKET-50244-53) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT NO. 1. Additional Information on Furnace-Sensitized Stainless Steel Valves. (Rochester Gas and Electric Corp., N. Y.). 26 Oct 1970. 2p. Dep. NTIS.

1828 (DOCKET-50245-41) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Authority to Operate at 2011 Mw Thermal. (Division of Reactor Licensing (AEC), Washington, D. C.). 26 Oct 1970. 2p. Dep. NTIS.

1829 (DOCKET-50250-32) TURKEY POINT PLANT, UNITS NO. 3 AND NO. 4. Additional Information Requested on FSAR. Preliminary Safety Analysis Report, [Amendment 25], Suppl. 25. (Florida Power and Light Co.). 2 Oct 1970. 27p. (DOCKET-50251-30). Dep. NTIS.

1830 (DOCKET-50250-34) TURKEY POINT PLANT, UNITS NO. 3 AND NO. 4. Preliminary Safety Analysis Report, [Amendment 28], Suppl. 28. (Florida Power and Light Co.). 6 Nov 1970. 47p. (DOCKET-50251-32). Dep. NTIS.

Revised design parameters of the Turkey Point Power Reactor Units 3 and 4 are presented. Included also are additional data on the reactor requested by the Division of Reactor Licensing. (D.C.C.)

1831 (DOCKET-50261-44) H. B. ROBINSON UNIT NO. 2. Facility License No. DPR-23, Amendment 1. (Division of Reactor Licensing (AEC), Washington, D. C.). 23 Oct 1970. 5p. Dep. NTIS.

Revised limits on quantities of nuclear materials to be utilized and stored at the reactor are presented. (D.C.C.)

1832 (DOCKET-50266-31) POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2. Environmental Studies. Report No. PBR 1, Addendum. (Wisconsin Univ., Milwaukee. Dept. of Botany). Mar 1970. 7p. (DOCKET-50301-25). Dep. NTIS.

For Wisconsin Electric Power Co., Milwaukee and Wisconsin Michigan Power Co., Appleton, Wis.

Radioactivity levels for sediment samples taken near the reactor site are recorded. Data are presented for samples taken during April, June, August, and September 1969. (D.C.C.)

1833 (DOCKET-50285-37) FORT CALHOUN STATION, UNIT NO. 1. Preliminary Safety Analysis Report, Amendment 20 (Includes Final Safety Analysis Report, Suppl. No. 3). (Omaha Public Power District, Nebr.). 4 Nov 1970. 63p. Dep. NTIS.

Revised design parameters of the Fort Calhoun Power Reactor Unit 1 are presented. Included also are additional data on the reactor requested by the Division of Reactor Licensing. (D.C.C.)

1834 (DOCKET-50317-19) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Preliminary Safety Analysis Report, Additional Information. (Baltimore Gas and Electric Co., Md.). 26 Oct 1970. 14p. (DOCKET-50318-19). Dep. NTIS.

The thermal gradients and the unbalanced pressure for which the principal reinforced concrete structures in the containment were designed are described. (H.D.R.)

1835 (DOCKET-50338-25) NORTH ANNA POWER STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Amendment 12. (Virginia Electric and Power Co., Richmond). 2 Nov 1970. 37p. (DOCKET-50339-24). Dep. NTIS.

Revised articles of incorporation and by-laws of the Virginia Electric and Power Company are presented. (D.C.C.)

1836 (DOCKET-50348-12) JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2. Preliminary Safety Analysis Report, Amendment 6. (Alabama Power Co., Birmingham). 6 Oct 1970. 269p. (DOCKET-50364-6). Dep. NTIS.

Revised design parameters of the Joseph M. Farley Power Reactors, Units 1 and 2, are presented. Included also are additional data on the reactors requested by the Division of Reactor Licensing. (J.M.J.)

1837 (DOCKET-50348-13) JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2. Preliminary Safety Analysis Report, Amendment 7. (Alabama Power Co., Birmingham). 26 Oct 1970. 86p. (DOCKET-50364-7). Dep. NTIS.

Revised design parameters of the Joseph M. Farley Power Reactor Units 1 and 2 are presented. Included also are additional data on the reactor units requested by the Division of Reactor Licensing. (D.C.C.)

1838 (DOCKET-50352-8) LIMERICK GENERATING STATION, UNITS 1 AND 2. Applicant's Environmental Report, Construction Permit Stage. (Philadelphia Electric Co., Pa.). Oct 1970. 173p. (DOCKET-50353-8). Dep. NTIS.

Information concerning chemical, radioactive, and thermal discharges from the reactor is presented. The effects of reactor operations on the environment are analyzed. (D.C.C.)

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1839 (DOCKET-50358–7). WM. H. ZIMMER NUCLEAR POWER STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Amendment 1. (Cincinnati Gas and Electric Co., Ohio. Columbus and Southern Ohio Electric Co., Columbus, Ohio. Dayton Power and Light Co., Ohio). 3 Nov 1970. 226p. (DOCKET-50359–6). Dep. NTIS.

Additional information on the site for the William H. Zimmer Power Reactor Units 1 and 2 is presented. (D.C.C.)

1840 (DOCKET-50373–1) LA SALLE COUNTY STATION, UNITS 1 AND 2. Application for Construction Permits and Operating Licenses. (Commonwealth Edison Co., Chicago, Ill.). 3 Nov 1970. 4p. (DOCKET-50374–1). Dep. NTIS.

1841 (DOCKET-50373–2) LA SALLE COUNTY STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Vol. 1. (Commonwealth Edison Co., Chicago, Ill.). 3 Nov 1970. 701p. (DOCKET-50374–2). Dep. NTIS.

Information on La Salle County Power Reactor Units 1 and 2 is presented under the following broad topics: Introduction and Summary; Site; and Reactor. (D.C.C.)

1842 (DOCKET-50373–3) LA SALLE COUNTY STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Vol. 2. (Commonwealth Edison Co., Chicago, Ill.). 3 Nov 1970. 248p. (DOCKET-50374–3). Dep. NTIS.

Information on La Salle County Power Reactor Units 1 and 2 is presented under the following broad topics: Reactor Coolant System; Containment; and Core Standby Cooling System. (D.C.C.)

1843 (DOCKET-50373–4) LA SALLE COUNTY STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Vol. 3. (Commonwealth Edison Co., Chicago, Ill.). 3 Nov 1970. 361p. (DOCKET-50374–4). Dep. NTIS.

Information on La Salle County Power Reactor Units 1 and 2 is presented under the broad topic: Instrumentation and Control. (D.C.C.)

1844 (DOCKET-50373–5) LA SALLE COUNTY STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Vol. 4. (Commonwealth Edison Co., Chicago, Ill.). 3 Nov 1970. 431p. (DOCKET-50374–5). Dep. NTIS.

Information on La Salle County Power Reactor Units 1 and 2 is presented under the following broad topics: Electrical Power Systems; Radioactive Waste Systems; Auxiliary Systems; Power Conversion Systems; Station Structures and Shielding; Conduct of Operations; and Station Safety Analysis. (D.C.C.)

1845 (NP–18494) THERMAL PROFILE OF THE WATERS OF NEW YORK STATE. (New York State Atomic and Space Development Authority, New York). [1969]. 27p.

A water temperature survey of the major bodies of water in New York State is described. The survey produced data on natural and man-made sources of heat in rivers, lakes, and coastal areas. The survey was made from aerial scanning of the water bodies with infrared sensing devices. The data will be used in the site selection for future nuclear power plants. (D.C.C.)

1846 IAEA SAFEGUARD INSPECTION OF COMMERCIAL POWER-GENERATING REACTORS. Takaya, Koji (Japan Atomic Power Co., Tokyo). Denryoku Shinpo; 16: No. 3, 35-40 (Feb 1970). (In Japanese).

Safeguard inspection and the influence on the Japanese atomic industry are described. The system of IAEA for the safeguard measures, including the inspection of design, the recording of reactor operation, the presentation of reports, and on-the-spot inspection is analyzed. The experience in the inspection of the Tokai power station is reviewed. The transfer to IAEA of the security measure concerning the Tsuruga atomic power station is described. The inspection under the nuclear-diffusion prevention treaty is discussed. (Japan)

1847 CONSTRUCTION PLAN ON THE SHIMANE ATOMIC POWER STATION. Minami, Ichiro (Chugoku Electric Power Co. Inc., Hiroshima). Kensetsu No Kikaika; No. 239, 14-17 (Jan 1970). (In Japanese).

The full scale survey for the Shimane Power Reactor was started in 1966. Subsequently in 1967, preparation of the site was started and is 85% complete at present. The atomic power station employs a BWR of heat output 1,380 MW; coolant water for the condensers is taken from the sea. The following are described: the reactor plant; the site geology, earthquake, and sea state; securing the site; and site preparation and other civil engineering works such as roads, and works on the coast including breakwater, shore protection and water intake. (Japan)

Steam and Power Conversion Systems

Refer also to abstract 309.

Power Reactor Development

Refer also to abstracts 299–303, 347, 702, 704, 724, 725, 745–747, 775, 779, and 782.

1848 (ANL–7742) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, SEPTEMBER 1970. (Argonne National Lab., Ill.). 23 Oct 1970. Contract W-31-109-eng-38. 177p. Dep. NTIS.

Highlights of project activities for September 1970 are summarized. LMFBR physics development and component development are reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects, fuel fabrication, and operations are summarized. Reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. (D.C.C.)

1849 (ANL-Trans–858) MISTRAL: THERMODYNAMIC MIXED FLOW ALGORITHM FOR ROD ASSEMBLIES (16740). Baumann, W. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorbauelemente). Translated for Argonne National Lab., Ill., from report KFK–988. 32p. Dep. NTIS.

A description is given of a digital computer program for the calculation of the local temperature and mass flux in the cooling channels of a fuel element consisting of 61 rods. The computer method considers that the temperature difference between the central and near the wall cooling channels was affected by expansion, heat conductivity, and cross mixing of the coolant. The method was confirmed by studies which serve for the determination of the coolant cross mixing in air-cooled rod bundles. It was shown that a good agreement exists between the digitally calculated and the measured temperature profiles. The calculation method was also used for bundles with various spacers with sodium, steam, and helium as coolant. The method offers the possibility of estimating the case of skewed thermal load which is experimentally difficult to determine. (tr-auth)

1850 (CEA-R–3987) FISSION PRODUCTS IN A FUEL IRRADIATED UNDER VARIABLE CONDITIONS (PROGRAM PROFIS). Bessis, Joseph; Virefleau, Robert (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Oct 1970. 47p. (In French). Dep. NTIS (U. S. Sales Only).

The computer code PROFIS was used to evaluate the fission product concentrations in a given fuel irradiated under specified conditions. It takes into account the neutron energy spectra in the fuel, fuel composition, capture effects, changes with respect to time in the reactor running power, and possible changes with respect to time in the neutron spectra and fuel composition. The calculation methods and formulas used are given. A very brief description of the program is given. 21 references. (auth) (France)

1851 (EURFNR–822) FAST REACTOR PROGRAM, FOURTH QUARTER 1969. Progress Report, October –December 1969. Hoekstra, E. K. (comp.) (Reactor Centrum Nederland, Petten). Jul 1970. 116p. (RCN–120). Dep. NTIS (U. S. Sales Only).

Work Performed under United States–Euratom Fast Reactor Exchange Program.

The RCN program comprises reactor physics, fuel performance, radiation damage in canning materials, corrosion behavior in canning materials, aerosol research, heat transfer, and hydraulics. 12 references. (auth)

1852 (ORNL-TM–3177) MOLTEN SALT BREEDER EXPERIMENT DESIGN BASES. McWherter, J. R. (Oak Ridge National Lab., Tenn.). Nov 1970. Contract W-7405-eng-26. 55p. Dep. NTIS.

The design bases for the Molten Salt Breeder Experiment (MSBE) are based on information from the MSRE and the reference plant design of a 1000 MW(e) single-fluid Molten Salt Breeder Reactor (MSBR). Calculations indicate that a 150 MW(thermal) reactor is a reasonable size that would meet the project objectives for the MSBE. The primary salt for the MSBE contains both the fissile (^{233}U) and the fertile (Th) material. The heat generated in the primary system is transferred by a secondary salt loop to the steam generators. Provisions are made in the MSBE core to permit exposure of removable graphite samples at conditions similar to those expected in the MSBR. The pumps and heat exchangers in the MSBE are similar to those proposed for the MSBR. 12 references. (auth)

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1853 PROBLEMS OF CONSTRUCTION OF ATOMIC STEAM-GAS PLANTS. Ratnikov, E. F. At. Energ. (USSR): 29: 77-80 (Aug 1970). (In Russian).

Data concerning heat and economic efficiency of steam-gas plants are given. There is a conclusion of their very promising future for atomic energy. The possibilities and conditions of producing high-temperature equipment for such plants (a nuclear reactor, a gas turbine) are considered. An investigation is made of the working medium problem for the gas circuit and, as a result, the application of helium is found advisable. There are also data of comparative analysis of three types of atomic power plants. (auth)

1854 NUCLEAR POWER STATIONS. (to Sulzer Brothers Ltd.). British Patent 1,210,569. 28 Oct 1970. Priority date 19 Sep 1967, Switzerland.

REACTORS, GAS-COOLED—power conversion system for compact, optimum arrangement of
REACTORS, POWER—power conversion system for component gas cooled, optimum arrangement of (D.C.C.)

1855 STATE OF DEVELOPMENT OF MOLTEN SALT REACTORS. Takeda, Eiichi (Tokyo Inst. of Tech.). Genshiryoku Kogyo; 16: No. 3, 28-31(Mar 1970). (In Japanese).

The features of an MSR are explained in comparison with the heterogeneous (solid fuel) reactor. Design features of the MSBR are reviewed. The two types of MSBR, developed at ORNL, are described. Economic aspects of MSRs are analyzed. (Japan)

1856 STATE OF DEVELOPMENT OF HIGH-TEMPERATURE GAS COOLED REACTORS. Yasukawa, Shigeru (Japan Atomic Energy Research Inst., Tokai). Genshiryoku Kogyo; 16: No. 3, 19-27(Mar 1970). (In Japanese).

The state of development of HTGRs is reviewed in association with the future thorium cycle. Changes in the design features are described. Fuel particles, and the various forms of fuel elements are described. Various factors involved in the thorium cycle for HTGRs are analyzed. (Japan)

1857 STATE OF DEVELOPMENT OF REPETITION-TYPE PULSED FAST REACTORS. Sumita, Kenji (Osaka Univ.). Genshiryoku Kogyo; 16: No. 3, 57-64(Mar 1970). (In Japanese).

The history of neutron sources and the nature of a (single) pulsed reactor are first described. The necessity for a repetition-type pulsed reactor is discussed. The repetition-type pulsed reactors utilize the following: subcritical state, delayed-neutron and prompt-neutron criticalities, maximum multiplication factor, and neutron pulses from an accelerator. The booster, IBR and its series, SORA, PFRR, and RPTF and UINS are described. The development program for repetition-type pulsed reactors in Japan is explained. (Japan)

1858 MOLTEN-SALT-FUELED NUCLEAR BREEDER REACTOR AND FUEL CELL FOR USE THEREIN. Bettis, Edward S. (to United States Atomic Energy Commission). U. S. Patent 3,527,669. 8 Sep 1970. Filed 20 May 1968.

A molten-salt-fueled nuclear breeder reactor comprising a multiplicity of vertically oriented graphite fuel cells arranged in a bundle to form an active core region is described. Each cell comprises three concentric tabulations with axially extending passageways therebetween as well as through the innermost tabulation. The passageways provide a separate circuit for molten salt containing fissile material and for molten salt containing fertile material. A blanket region surrounds the active core region and reactivity control is achieved by displacement of molten salt containing fertile material within the interstices of the fuel cells. (Offic. Gaz.)

1859 IMPROVEMENTS IN AND RELATING TO SOLID NEUTRON MODERATING CORE STRUCTURES FOR NUCLEAR REACTORS. Pettinger, Donald Stanley (to Nuclear Power Group Ltd.). British Patent 1,209,033. 14 Oct 1970. Filed 17 Mar 1967.

In conventional graphite core structures the dimensional changes in the graphite as a result of temperature changes and irradiation can produce differential shrinkage or growth, resulting in an unstable core structure. The object of the system described is to provide a core structure that can accommodate these dimensional changes and that is inherently self-stabilizing. The core structure comprises an assembly of prismatic graphite blocks arranged in vertical columns with the opposed end faces of adjacent blocks in at least some of the columns so shaped that one face can roll over the other and such that when the blocks are assembled in the column the lines of contact between adjacent opposed faces are arranged so that overturning moments are exerted on the blocks causing them to lean in mutually supporting relationship in a predetermined manner on blocks in adjacent columns. Lateral constraining means surround the core structure to counteract lateral outward forces around the periphery of the core. The blocks may be of any cross-sectional shape that permits interfitting of blocks of adjacent columns so as to keep the size of voids between adjacent columns within acceptable limits. Various alternative structural designs are described. (UK)

1860 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR CHARGE TUBES. Harte, James Martin; Willson, Charles Frederick Edwin (to Atomic Power Constructions Ltd.). British Patent 1,208,743. 14 Oct 1970. Filed 30 Nov 1967.

Reference is made to charge tubes for the gas cooled, graphite-moderated pressure bell type of reactor. In such reactors deflection of the lower end of the charge tubes may occur resulting in a high accumulation of load in the outer graphite blocks of the core top reflector. In the system described this is avoided by employing two different types of charge tubes, grouped into inner and outer zones, the inner zone tubes being of conventional design. Some at least of the charge tubes are joined in such a manner as to allow relative angular displacement of the axes of the two portions. The joint may comprise two telescopically engaged section, one of which is attached to the pressure vessel dome or bell while the other section may be radially separated by an annular space. One section may include a pivot surface on which the other section may roll. This section may be cylindrical and the pivot surface may comprise an annular projection on this section, which may also have inner and outer coaxial tubular elements. In one arrangement the charge tubes of the outer zone may be broken above the upper shield level, and re-entrant gas may pass through the gap at the joint and provide sufficient cooling to allow the use of 9% Cr 1% Mo steel for the joint and the lower portion of the charge tube, or it may be possible to keep the gas temperature sufficiently low to allow the use of normal carbon steel. (UK)

1861 FAST BREEDER REACTORS. Seaborg, Glenn T.; Bloom, Justin L. Sci. Amer.: 223: No. 5, 13-21(Nov 1970).

General design concepts and physics related to fast breeder reactors are described. Research and development projects for both gas-cooled and liquid metal-cooled fast breeder reactors are reviewed. A listing of fast breeder reactors in operation, under construction, or planned is presented. (D.C.C.)

1862 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Gratton, Charles Peter (to United Kingdom Atomic Energy Authority). British Patent 1,209,632. 21 Oct 1970. Filed 4 Apr 1967.

Reference is made to gas-cooled fast reactors. In the system described the fuel in the core and the blanket is in the form of separable assemblies, with provision so that the fissile assemblies can be moved towards the lower temperature end of the coolant channel and the fertile assemblies towards the higher temperature end as burn-up proceeds. The fissile fuel is preferably cermet, in plate form, a number of similar plates being supported in parallel planes in a frame in spaced relationship so as to define a coolant passage between each plate and its neighbour. Several such assemblies placed end to end, with the coolant passages contiguous, form a channel by which coolant passes through the core with low pressure drop. The cermet fuel preferably comprises Pu. The blanket fuel may be bulk fertile fuel oxide. Methods of operating such a reactor are described. (UK)

1863 FAST BREEDER REACTORS. (to Siemens Aktiengesellschaft). British Patent 1,211,255. 4 Nov 1970. Priority date 11 Jan 1967, Germany.

REACTORS, BREEDER—design of fast, with core configuration to minimize coolant void effect
REACTORS, FAST—design of breeder, with core configuration to minimize coolant void effect (H.D.R.)

1864 OPERATION OF PRESSURE-VESSEL NUCLEAR REACTOR INSTALLATIONS. (to Siemens Aktiengesellschaft). British Patent 1,211,249. 4 Nov 1970. Priority date 4 Jul 1967, Germany.

REACTOR FUEL ELEMENTS—replacement in heavy water cooled and moderated reactors, method for heavy water to gas to light water coolant change during
REACTORS, HEAVY WATER MODERATED—fuel element replacement in heavy water cooled pressure vessel type, method for direct visual observation of
—coolant change from heavy water to gas coolant to light water during refuelling operation, method for (H.D.R.)

Kinetics and Dynamics

Refer also to abstract 1959.

1865 (AECL-3691) THE STATUS OF HEAT AND MASS TRANSFER RESEARCH RELATED TO THE CANDU POWER REACTOR PROGRAM. McPherson, G. D. (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Aug 1970. 20p. (CONF-700924-1). Dep. NTIS (U. S. Sales Only). AECL $1.00.

From Panel on Heat and Mass Transfer in Nuclear Power Plants, Vienna, Austria.

A survey of the heat and mass transfer research in support of Canada's pressurized and boiling water cooled, heavy water moderated power reactors is presented. In the case of pressurized coolant the fuel elements may be power limited by the critical heat flux causing dryout at low coolant qualities and the booster rod channels may be limited by the critical heat flux causing departure from subcooled nucleate boiling. In the case of boiling coolant the average coolant quality is much higher and while dryout may be limiting, consideration is being given to infrequent operation in this condition. At Chalk River the major heat transfer activity is aimed at improving the prediction of conditions leading to dryout or departure from subcooled nucleate boiling and post dryout heat transfer in multi-element fuel bundles. Besides ad hoc testing of specific bundle geometries the program involves the preparation of a computer code for the prediction of subchannel coolant conditions and experimental support of this program. Safety considerations have led to a growing experimental program in support of transient and accident analysis. 18 references. (auth)

1866 (ANL-7664) DYNAMIC SIMULATION AND ANALYSIS OF EBR-II ROD-DROP EXPERIMENTS. Campise, A. V. (Argonne National Lab., Ill.). Mar 1970. Contract W-31-109-eng-38. 72p. Dep. NTIS.

The neutronic, thermal, and hydraulic characteristics of EBR-II were modeled with the AIROS-IIA dynamic-simulation program. The radial power and reactivity distributions in core and blanket regions were simulated by dividing the core and inner blanket into individual feedback channels, each representing an average fuel element in various rows of the reactor. Average power and flow rates were used to compute the temperature transients associated with rod-drop experiments; in turn, these temperatures were used with weighted temperature coefficients to compute the many temperature-induced reactivity feedbacks. These computations were applied to recent EBR-II power runs in which rod-drop experiments had been conducted; the computed results showed very good agreement with experimental data on power level and reactivity feedback for the first 40 sec following the rod drops. The dynamic-simulation model describes the response of the reactor for the first 40 sec as being due primarily to driver-fuel axial expansion and to density changes in the sodium coolant. These two sources of reactivity feedback appear to be sufficient to explain the variations measured in the rod-drop experiments. The dynamic-simulation model was also used to analyze EBR-II cores having a stainless steel reflector. A one-parameter variation study was conducted with all computed negative temperature coefficients held constant and a single positive feedback assumed to be due to reverse bowing in the stainless steel reflector. The computed results agree fairly well with measured rod-drop data and also with measured power-coefficient data from these cores. 12 references. (auth)

1867 (ANL-7686) NEW TECHNIQUE FOR INVESTIGATING FEEDBACK AND STABILITY OF A NUCLEAR REACTOR. EBR-II Project. Engen, Ivar A. (Argonne National Lab., Ill.). Jun 1970. Contract W-31-109-eng-38. 51p. Dep. NTIS.

The rod-drop technique for feedback and stability analysis of EBR-2 was evaluated in an attempt to develop a reliable, less expensive method of analysis compared to the established oscillation technique. Oscillation experiments determined system feedback in the frequency domain through use of a Fourier analysis technique. The rod-drop experiments determined the feedback in the time domain through use of an inverse-kinetics computation utilizing linearized, one-group-energy, space-independent, kinetics equations. Data for the computations were obtained from an ion-chamber signal and other signals that monitored the position of the reactivity perturbation mechanism. The two techniques were compared by developing mathematical models representing the feedback. Models developed from rod-drop experimental results were transformed to the frequency domain for direct comparison with the feedback determined by the oscillation technique. Two models developed from rod-drop experiments and one from the oscillation experiments were compared extensively and show that the two techniques determine similar models for representing reactor feedback. Physical limitations of both perturbation mechanisms limited the conclusions that could be drawn. However the rod-drop technique showed sufficient promise to warrant its continued use, particularly for feedback analysis at high reactor power levels, where the oscillation mechanism suffered restrictions on its operation. 12 references. (auth)

1868 (BNWL-1260) USER'S MANUAL FOR NOISY1: A PROGRAM FOR CALCULATION OF SPACE DEPENDENT SPECTRAL DENSITIES IN CUBICAL REACTORS. Sheff, James R. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Sep 1970. Contract AT(45-1)-1830. 79p. Dep. NTIS.

The features of the NOISY1 program for calculation of space-dependent auto and cross spectral density functions of the noise in a nuclear reactor are described. The modular or segmented construction of NOISY1 is described and emphasized as a useful feature. SEARCH/DESTRY and SNOOPY, two auxiliary programs for cal-comp graph construction, are also described. The programs are written in FORTRAN 5 for UNIVAC 1108. 6 references. (auth)

1869 (CEA-CONF-1580) SPATIOTEMPORAL STUDY OF A GRAPHITE GAS POWER REACTOR. Tellier, N.; Roux, P.; Deat, M. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). 1970. 13p. (In French). (CONF-700826-3). Dep. NTIS (U. S. Sales Only).

From Conference on Hybrid Computation, Munich, Germany.

The different stages of a spatiotemporal simulation of a nuclear reactor made on a hybrid computer are described. The purpose of this simulation is the evaluation of the performances of a EAI 9800 type hybrid computer in the resolution of an important system of partial differential equations. The results were compared with those obtained from a digital code resolving the same equations on a CDC 6600 computer. (France)

1870 (CEA-CONF-1582) HYBRID PROGRAM FOR SOLVING THE SPACE-TIME DEPENDENT DIFFUSION EQUATION IN FOUR ENERGY GROUPS. Saphier, D.; Merle, J. P. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). 1970. 9p. (CONF-700826-2). Dep. NTIS (U. S. Sales Only).

From Conference on Hybrid Computation, Munich, Germany.

A new method was developed to solve the space-time dependent diffusion equation in four energy groups and up to 100 meshpoints, with a hybrid computer. The limitations and field of application of this program, and a brief description of the Hybshov-code are given. It was found that the cost price of the resolution of a problem on a hybrid computer is lower than on a digital computer. (France)

1871 (RD/B/N-1749) USE OF A SMALL DIGITAL COMPUTER FOR A.G.R. OPERATIONAL CHANNEL POWER CALCULATIONS. Bending, R. C. (Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.). Jul 1970. 17p. Dep. NTIS (U. S. Sales Only).

The principles of using a small digital computer to calculate the axially-averaged two energy group neutron fluxes and channel powers in an advanced gas-cooled reactor for any fuel loading are presented. It is demonstrated that the system is feasible and shows a cost advantage over other calculational methods. A specification is made for a complete system. (auth) (UK)

1872 TIME-STEP LENGTH ERRORS IN DIGITAL SIMULATION OF SPATIAL XENON OSCILLATIONS. Poncelet, Claude G. (Carnegie-Mellon Univ., Pittsburgh); Christie, Alan M. Nucl. Sci. Eng.; 42: 236-9(Nov 1970).

A theoretical analysis of the errors introduced in the spatial xenon stability characteristics by the use of a nonzero time-step is presented. Such errors in the digital simulation of xenon oscillations in large PWR's are evaluated, and simple correlations which can be used to correct calculated growth rates and periods in uncontrolled calculations are developed. (auth)

Control Systems

Refer also to abstracts 776 and 1899.

1873 (JAERI-Memo-4114) THE CALIBRATION TECHNIQUE AND THE NEUTRON EXPOSURE CHARACTERISTICS OF THE JPDR IN-CORE MONITOR SYSTEM. Kawasaki, M.; Nakamura, T.; Tanaka, T. (Japan Atomic Energy Research Inst., Tokyo). Aug 1970. 32p. (In Japanese). Dep. NTIS (U. S. Sales Only).

The calibration technique of the JPDR in-core monitor system and its neutron exposure characteristics which could be obtained from the calibration data during the JPDR operation from October 1963 to September 1969 are described. The data revealed that the neutron sensitivity of each monitor dropped rapidly at the beginning of service, and subsequent to this, fell gradually as the neu-

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tron exposure increased. It also showed that each falling slope of the neutron sensitivity varied with monitor and was steeper than that expected from the burnup of the neutron-reacting-material of the monitor. (auth) (Japan)

Shielding

1874 (EUR-4498) STUDY OF THE NEUTRON STREAMING THROUGH CYLINDRICAL DUCTS WITH TWO BENDS IN WATER: EXPERIMENTS. Final Report. Chinaglia, B.; Bosio, G.; Monti, D. (Societa Ricerche Impianti Nucleari, Saluggia (Italy)). 17 Apr 1970. 62p. Dep. NTIS (U. S. Sales Only). EUR FF 9.45.

The problem of neutron streaming through cylindrical bent ducts in water has been studied with a set of experiments in which both the angle and the diameter have been changed (four values for the angle from 15 to 90° and two values for the diameter: 15 and 30 cm). The results expressed as reaction rates for threshold neutron detectors and thermal and epithermal flux are presented in tables and graphs. 6 references. (auth)

1875 (N-70-32598) UNAMIT: A ONE-DIMENSIONAL 4 π SPHERICAL MULTILAYER REACTOR-SHIELD-WEIGHT OPTIMIZATION CODE. Troubetzkoy, Eugene S.; Wohl, Millard L. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Jul 1970. 21p. (NASA-TM-X-2048; E-5619). NTIS.

The computer code UNAMIT is described. The code generates 4 π multilayer spherical reactor shields of minimum weight subject to a fixed shield surface dose rate constraint. The code uses an exponential attenuation–secondary-production analytic model. Methods are presented for determining required input parameters for attenuation of primary neutrons, primary gamma rays, and secondary gamma rays, and for production of secondary gamma rays. Discussion of the pertinent theory and operation of the code is presented in addition to listings of the code in Fortran IV and Fortran 63. Full input instructions and a sample problem output listing are presented. (auth) (STAR)

1876 SHIELDING OF FAST BREEDERS. Albrecht, L.; Gegusch, M.; Schimmel, W. (Staatliche Zentrale fuer Strahlenschutz, Berlin). Kernenergie; 13: 237-42(Aug 1970). (In German).

The differences in fast breeder shielding as compared with thermal reactors result from higher fast flux and activation of the generally metallic coolants. Criteria for shield layouts are more extensive than those for thermal reactors. The principal structure of the shields for fast breeders may be divided into primary, secondary, and biological shields which have to fulfill more or less different tasks. The recently favored coolant is Na though its radiation properties are worse in comparison with those of other liquid metals under consideration. Inhomogeneities in the shield also represent a problem of fast reactor shielding, where the so-called material-filled gaps are worth special notice. General demands made in selection of shielding materials and shield design are described. (32 references) (auth)

Cooling Systems

1877 (ANL/EBR-16) SUITABILITY OF SOME COMPONENTS OF THE EBR-II SODIUM SYSTEMS FOR OPERATION AT 62.5 MWt. EBR-II Project. Bulut, N. (Argonne National Lab., Ill. Argonne National Lab., Idaho Falls, Idaho). Jul 1970. Contract W-31-109-eng-38. 59p. Dep. NTIS.

In preparing for operation of EBR-2 at 62.5 MW(t), the stress criteria that guided the original design of the major components of the EBR-2 sodium systems were re-evaluated and, in some cases, re-analyzed. The philosophy behind the codes on which the original design was based had changed since that design was completed. The re-evaluation and re-analysis of stresses due to static, thermal steady-state, and thermal transient loadings show that the major components have sufficient structural integrity for 62.5 MW(t) operating conditions. 5 references. (auth)

1878 (ANL-Trans-857) QUESTIONS CONCERNING THE DETECTION OF THE ENTRY OF WATER INTO SODIUM. Subbotin, V. I.; Kozlov, F. A.; Kuznetsov, E. K.; Sergeev, G. P. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Obninsk. Fiziko-Energeticheskii Institut). Translated by Gerda Siegel (Argonne National Lab., Ill.), from Russian report. 33p. Dep. NTIS.

A leak detection method for water and sodium systems is developed. The method is applied to boilers of liquid sodium-cooled fast reactors. The method is based on the diffusion of hydrogen from sodium through a nickel membrane and the continuous monitoring of the gas phase by chromatography. 4 references. (D.C.C.)

1879 (DP-Report-229) THE PRIMARY CIRCUIT GAS BEARING CIRCULATORS FOR THE DRAGON REACTOR EXPERIMENT. Project DRAGON. Mech, Christian (Societe Rateau, La Corneuve, (France). United Kingdom Atomic Energy Authority, Risley (England). Reactor Group). Oct 1963. 7p. (CONF-631012-9). Dep. NTIS.

From Dragon Project Engineering Symposium, Bournemouth, Eng.

A brief description is given of the main coolant circulators and the auxiliary compressors for the helium purification plant and the gas purge precooler. (auth)

1880 (GEAP-10207) REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY. Quarterly Report No. 21, April–June 1970. (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). Jul 1970. Contract AT(04-3)-189. 48p. Dep. NTIS.

PIPES—failure in reactor cooling systems, probability analysis of
—crack initiation and growth in reactor cooling systems, effects of low-cycle fatigue on, (E)
REACTORS, BOILING—cooling systems for, effects of corrosion on low-cycle fatigue life of piping in, (E)
REACTORS, WATER COOLED—cooling systems for, failure mechanisms in piping of, (E/T)
STEEL—crack initiation and growth in A106B carbon, effects of low-cycle fatigue on, (E) (H.D.R.)

1881 NUCLEAR REACTOR POWER SYSTEM. Boardman, Charles Edward; Schneider, Henry John; Shoopak, Bernard Frederick; Wolfe, Bertram (to General Electric Co.). British Patent 1,210,687. 28 Oct 1970. Priority date 11 Jan 1967, United States.

REACTORS, POWER—cooling system for steam cooled, thermal characteristics of optimum
REACTORS, SUPERHEATING—cooling system for steam cooled power, thermal characteristics of optimum (D.C.C.)

1882 VESSEL PROVIDING RESISTANCE TO HIGH PRESSURES. Frohly, Leon (to Commissariat a l'Energie Atomique). British Patent 1,209,957. 28 Oct 1970. Priority date 10 Feb 1967, France.

PRESSURE VESSELS—description of pressurized water reactor prestressed concrete and steel laminated
REACTORS, PRESSURIZED-WATER—pressure vessels for, description of prestressed concrete and steel laminated (D.C.C.)

1883 NATURAL OSCILLATIONS OF THE BUBBLE-LIQUID MIXTURE IN SUBCOOLED BOILING. Fuge, R. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Kernenergie; 13: 245-53(Aug 1970). (In German).

Periodicities of the boiling noise observed in subcooled boiling with forced convection are interpreted as the natural oscillations of the bubble-liquid mixture. The natural frequencies of the system are determined by sound velocity in the mixture. Since density of the mixture follows pressure fluctuations nearly without relaxation, sound velocity strongly depends on vapor content. This only applied to subcooled boiling. Therefore, vapor content may be calculated from the natural frequencies observed. Using similarity considerations an equation is derived for vapor content to be determined as a function of the system characteristics (pressure, liquid temperature, flow rate, heat current density). On the basis of noise technique portions of vapor mass could be determined down to 10^{-7}. (10 references) (auth)

1884 IMPROVEMENTS IN OR RELATING TO GAS-COOLED NUCLEAR REACTORS. Nairn, John Syme (to United Kingdom Atomic Energy Authority). British Patent 1,208,378. 14 Oct 1970. Filed 20 Nov 1968.

Reference is made to means for removing dust and other particulate matter from the coolant circuits of gas-cooled reactors. Conventional filtration systems using filter elements are not suitable for this purpose since they restrict coolant flow and are also expensive. In the system described a magnetic filter is employed. It has been found that there is a component in the dust that is attracted to and held by a magnetized surface and that carbonaceous and other materials are deposited with it. Several spaced magnetic filters can be included in a coolant circuit, with little or no additional restriction to coolant flow. (UK)

1885 SODIUM FLOW MEASUREMENT IN PFR. Thatcher, C.; Bentley, P. G.; McGonigal, G. (United Kingdom Atomic Energy Authority, Risley, Eng.). Nucl. Eng. Int.; 15: 822-5(Oct 1970).

The flow rate in the secondary circuit of the PFR is measured with a specially developed saddle-coil electromagnetic flowmeter giving an output proportional to flow with an accuracy of ±3%, and requiring no calibration. Flow in the primary circuit is measured from the transit time of naturally occurring temperature fluctuations. Principles of the methods are discussed. (UK)

1886 WATER CONDITIONING IN A NUCLEAR PLANT FOR TESTING FUEL ELEMENTS. Di Pietro, R.; Gadda, F.; Ronchetti, C. (CISE, Milan). Energ. Nucl. (Milan); 17: 588-96 (Oct 1970). (In Italian).

Characteristics of the coolant in water reactors are briefly reviewed and the possibility is considered of using water with addition of a small amount of NH_3 as coolant of the CIRENE reactor. First experimental results—obtained with an experimental loop—are reported on the concentration of crud and the production of radiolitic gases when the loop water is added with a few ppm of NH_3. (auth)

1887 PRESTRESSED CONCRETE PRESSURE VESSEL FOR NUCLEAR REACTOR. Cruset, Jean-Louis; Launay, Pierre; Lemasson, Jacques (to Commissariat a l'Energie Atomique). British Patent 1,210,890. 4 Nov 1970. Priority date 3 Jul 1967, France.

PRESSURE VESSELS—design of cylindrical prestressed concrete, with large opening for servicing reactor internals
REACTORS—pressure vessels for, design of cylindrical prestressed concrete (H.D.R.)

Fuels

Refer also to abstracts 39, 199, 212, 628, 719, and 720.

1888 (GEAP-10028-35) SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM. Quarterly Report No. 35, May-July 1970. (General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation). Sep 1970. Contract AT(04-3)-189. 161p. Dep. NTIS.

FAST CERAMIC REACTOR—fuel elements for, development during May to July 1970
—core for, design and kinetics analyses of
—safety of, transient overpower and coolant loss effects on
LIQUID METAL FAST BREEDER REACTOR—fuel elements for, development of stainless steel clad plutonium oxide (PuO_2-uranium oxide (UO_2)
NEUTRONS, FAST—effects on mechanical properties and swelling of stainless steel fuel element cladding, (E)
PLUTONIUM OXIDES PuO_2—PuO_2-UO_2, radiation effects testing of fuels of
—PuO_2-UO_2, properties of fuels of, mechanical, physical, and thermal, (E)
REACTOR FUEL ELEMENTS—performance of defected mixed oxide, in flowing sodium, (E)
—cladding for mixed oxide fast, development and testing of stainless steel
—radiation effects testing of mixed oxide fast
STAINLESS STEEL—radiation effects on swelling and mechanical properties of Type 304 and Type 316, fast neutron, (E)
URANIUM OXIDES UO_2—PuO_2-UO_2, radiation effects testing of fuels of
—PuO_2-UO_2, properties of fuels of, mechanical, physical, and thermal, (E) (H.D.R.)

1889 (RD/B/N-1622) FACTORS INFLUENCING THE STRENGTH OF COMPOSITE FUEL BODIES. Ashford, J. P. (Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.). May 1970. 42p. Dep. NTIS (U. S. Sales Only).

The factors influencing the strength and elastic behavior of composite fuel bodies are reviewed and the importance of micromechanical stresses caused by different elastic properties of the separate phases are discussed. Fracture studies on 4 point bending beams are used to assess strength and elastic properties of composite fuel bodies with volumetric loading of zero, 20% and 35% of UO_2 microspherical coated particles. The integrity of the coated particle fuel does not appear to be influenced by the crack propagation through the matrix. (auth) (UK)

1890 THORIUM FUEL CYCLE IN TERMS OF FUTURE ENERGY DEMAND. Takahashi, Minoru (Central Research Inst. of Electric Power Industry, Tokyo). Genshiryoku Kogyo; 16: No. 3, 6-11(Mar 1970). (In Japanese).

The structure, fuel economy and construction problems of the thorium power reactor are analyzed. The high temperature gas reactor is one of the power reactors of the next generation. The application of thorium fuel into the power reactor system of proven types is discussed. (Japan)

1891 FUTURE PROBLEMS IN THE THORIUM FUELS. Suzuki, Hiroshige (Tokyo Inst. of Tech.). Genshiryoku Kogyo; 16: No. 3, 12-18(Mar 1970). (In Japanese).

The thorium fuel cycle is attracting interest because of the success of high-temperature gas cooled reactors and molten salt reactors. The anticipated short supply of uranium due to the boom of light-water reactors is also another factor. The description is made of thorium fuel cycle for the case of HTGRs. The thorium fuels, used in various reactors, include metal, oxide, carbide and fluoride. The merits of thorium fuels include the superior fissile quality of ^{233}U. The demerits include poor neutron economy to reduce the ^{233}U yield. Problems when used in HTGRs are analyzed. (Japan)

1892 PROVING TEST OF NUCLEAR FUEL MADE IN JAPAN. Taketani, Kiyoaki (Japan Atomic Energy Research Inst., Tokai). Shin Kinzoku Kogyo; 15: No. 1, 1-5(Jan 1970). (In Japanese).

The development and production of the nuclear fuel for light water power reactors in Japan are described. The irradiation test of UO_2 fuel is analyzed. Brown curd was deposited on the surface of irradiated fuel at various irradiation period and burn-up. The nuclear fuel made in Japan performed sufficiently under the test condition. (Japan)

1893 IMPROVEMENTS IN AND RELATING TO STABILISING DEVICES FOR MEMBERS LOCATED IN BORES AND SUBJECT TO FLUID PRESSURE. Butt, Donald Frederick Charles; Bryant, Torance Graham (to Nuclear Power Group Ltd.). British Patent 1,208,613. 14 Oct 1970. Filed 8 Nov 1967.

During insertion of fuel element stringers into gas-cooled graphite-moderated reactors, the stringer is subject to forces due to gas pressure which may produce vibration and rattling of the graphite tubes housing the fuel elements. In the system described a member carrying a stabilizing device is located in the bore. The stabilizing device includes at least one brush-type seal positioned between the member and the wall of the bore to restrict gas flow and thereby stabilize the member. The member may comprise a fuel element in the stringer. The brush-type seal may consist of metal fibers embedded at one end in a metal ring. Stainless steel can be used for both the fibers and the ring; alternatively a ceramic material or graphite may be employed. It is not essential that the ring and fibers be of the same material. The seal may form a complete ring or may take the form of separate arcuate segments. Two or more seals may be located at intervals along the length of the stringer. Flexible sealing membranes, consisting of segments of sheet or woven material, may be included between pairs of seals to improve the sealing properties. (UK)

1894 IRRADIATION TESTS ON METALLIC URANIUM FUEL TUBES FOR CIRENE REACTORS. Morandi, G.; Scaroni, A. (CISE, Milan). Energ. Nucl. (Milan); 17: 579-87(Oct 1970).

The irradiation tests on metallic uranium (dilute alloy) fuel tubes coextruded with Zircaloy-2 cladding are described. Dimensional variations at the end of irradiation (maximum burn-up 3,300-3,700 MWd/tU) are evaluated from surface temperature measurements and are compared with similar data obtained in the Savannah River Laboratories (USA). (auth)

1895 MECHANICAL REQUIREMENTS OF THE LMFBR. Koch, L. J. (Argonne National Lab., Ill.). Nucl. News; 13: No. 11, 61-5(Nov 1970).

Design tolerances for core components of LMFBR's are analyzed. Typical design specifications for fuel elements, control elements, core support structure, and loading devices are described. EBR-2 design parameters are presented. (D.C.C.)

1896 ANALYSIS OF ENERGY AVAILABILITY OF HETEROGENEOUS POWER REACTORS. Siegel, Karl (Univ., Stuttgart). Brennst.-Waerme-Kraft; 22: 434-40(Sep 1970). (In German).

The energy availability of the fuel in a power reactor is followed from its point of release to the conversion into electrical energy. The amount of the energy is calculated after each irreversible process in the reactor. This makes it possible to assess the individual stages of energy devaluation. The results of a fully calculated example are shown in an energy flow diagram. 5 references. (auth)

Auxiliary and Emergency Systems

Refer also to abstracts 75, 215, and 1924.

1897 (IN-1390) EXPERIMENTAL RESULTS OF THE FUEL HEATUP SIMULATION TESTS (FHUST): EMERGENCY CORE

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COOLING TEST SERIES. Jensen, R. T. (Idaho Nuclear Corp., Idaho Falls). Sep 1970. Contract AT(10-1)-1230. 45p. Dep. NTIS.

Bench-type bottom flooding coolant injection tests with 9- and 49-rod arrays of 30- and 36-inch uniformly electrically heated rods, respectively, were performed to determine the heat transfer mechanisms occurring during emergency core cooling (ECC) injection and to provide data to be used in developing thermodynamic models for predicting core temperature response during ECC. Several flow and heat transfer regimes occurred. These regimes included convection in water, nucleate boiling at the quenching front, flow film boiling in an annular two-phase flow, film boiling in dispersed two-phase flow, and convection in superheated steam. 7 references. (auth)

1898 (MRR-57) COMPARISON OF THE SURVIVAL PROBABILITY OF REACTOR SAFETY SYSTEMS WITHOUT CONSIDERATION OF REPAIRS. Gieseler, H. (Technische Hochschule, Munich (West Germany). Institut fuer Mess- und Regelungstechnik). Dec 1969. 100p. (In German). Dep. NTIS (U. S. Sales Only).

By means of probability calculation and Boolean algebra, various reactor safety systems were analyzed. Computations were based on the following conditions: no difference was made between dangerous and insignificant failures; at time zero, all systems are 100% dependable; repairs were not considered; failure rate of the same structural components were equal; for electronic instruments and components, an exponential failure distribution was assumed; for mechanical components, normal failure distribution was accepted; and the monitoring devices in each channel were equal in construction but independent of each other. Based on these premises, three safety systems were analyzed. The first was designed for a pressurized water reactor; the second for a boiling water reactor; and the third operated in a gas-cooled reactor for several years. Safety factors for the three systems were compiled and methods for improvement were proposed. 24 references. (H.B.G.)

1899 (NEDO-10189) AN ANALYSIS OF FUNCTIONAL COMMON-MODE FAILURES IN GE BWR PROTECTION AND CONTROL INSTRUMENTATION. Frederick, L. G. (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). Jul 1970. 216p. Dep. NTIS.

Analyses of the effects of a broad spectrum of simultaneous multiple functional failures in critical safety and protection equipment in boiling water reactors are presented. Types of common-mode failures are described. Protection against these failures is analyzed. The analysis of functional diversity aspects of boiling water reactor instrumentation is emphasized. (D.C.C.)

1900 GAS-COOLED NUCLEAR REACTORS. (to Siemens Aktiengesellschaft). British Patent 1,210,184. 28 Oct 1970. Priority date 14 May 1968, Germany.

REACTORS, BREEDER—emergency core cooling system for gas cooled fast, description of melted core
REACTORS, FAST—emergency core cooling system for gas cooled breeder description of melted core
REACTORS, GAS-COOLED—emergency core cooling system for fast breeder, description of melted core (D.C.C.)

1901 DISPLACEMENT VELOCITY OF CALEFACTION POINT IN THE EMERGENCY COOLING FOR REACTOR FUEL ELEMENTS. Yoshioka, Keisuke (Kyushu Univ., Fukuoka); Matsumoto, Shigehiko; Hasegawa, Shu. Mem. Fac. Eng., Kyushu Univ.; 29: 155-63(Mar 1970).

The measurement of the displacement velocity of calefaction point in the emergency cooling for reactor fuel elements is reported. The test section was made from a stainless steel tube. The test section was held vertically and a water distributor is arranged on the upper connecting rod of the test section. The experimental results of displacement velocity are presented. The results were treated by one dimensional analysis. The treatment showed that both large heat transfer coefficient and the high temperature of calefaction point are required to obtain the good agreement of the theory and the experiment concerning the displacement velocity. Because of the failure of one dimensional treatment, the displacement velocity of calefaction point was treated as a subject of two dimensional heat conduction. The surface temperature and the temperature difference between the outer and inner surfaces of the wall were estimated. The results of the estimation were in good agreement with the experimental results. The principal difference from the one dimensional model is the presence of relaxation behavior which is liable to cause some large depression of surface temperature by a little heat removal at the liquid boundary near the surface. (Japan)

1902 TREATMENT OF REACTOR EXHAUST GASES AND OF EXHAUST AIR FROM BUILDINGS IN THE NUCLEAR POWER STATION WITH A BOILING-WATER REACTOR. Queiser, Horst (AEG-Telefunken, Frankfurt am Main). At. Strom; 16: 115-18(Aug 1970). (In German).

Reactor exhaust gases and contaminated air from buildings in reactor installations must be subjected to thorough decontamination before they are released. In nuclear power stations with AEG boiling-water reactor installations various methods are used to achieve this, suitable systems being applied. When the reactor exhaust gases have finally been purified and made inactive they are mixed with the air from buildings and released into the atmosphere; they produce in the neighbourhood of the power station negligible doses in comparison with natural environmental radiation. (auth)

1903 FEEDING PLANT FOR FUEL ELEMENTS OF A PEBBLE BED REACTOR. Hennings, U. BBC-Nachr.; 52: 144-9(1970). (In German).

Spherical fuel elements call for a particular construction of the charging system. The fuel elements added on the top of the pebble bed pass through the reactor core and reach the lower outlet after a transit time of half a year on an average. Here all the fuel elements are caught by a charging and controlling system. After this the fuel elements are carried forward. The requirements for the design of a fuelling system, applied solutions, and findings with the AVR charging mechanism, are described. (auth) (INIS)

1904 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUELLING SYSTEMS. (to Gulf General Atomic Inc.). British Patent 1,211,445. 4 Nov 1970. Priority date 14 Apr 1967, United States.

REACTOR LOADING MACHINES—design with improved means for supporting and handling core elements within pressure vessels
REACTORS, GAS COOLED—core elements for, system for supporting and handling of (H.D.R.)

Operation and Economics

Refer also to abstract 1952.

1905 NUCLEAR FUEL CONTRACTING ALTERNATIVES AND PROBLEMS. Stobbs, J. J. (Electro-Watt Engineering Services, Zurich). Nucl. Eng. Int.; 15: 803-8(Oct 1970).

The contribution of the various steps of the fuel cycle to total fuel cycle costs are illustrated for light water reactors, AGR, and CANDU. Possible alternative fuel supply schemes with different divisions of responsibility between the utility and the supplier are presented. The advantages and disadvantages of each are evaluated. (UK)

Safety and Siting

Refer also to abstract 1897.

1906 (ANL-7469) SURVEY AND STATUS REPORT ON APPLICATION OF ACOUSTIC-BOILING-DETECTION TECHNIQUES TO LIQUID-METAL-COOLED REACTORS. Anderson, T. T.; Mulcahey, T. P.; Hsu, C. (Argonne National Lab., Ill.). Apr 1970. Contract W-31-109-eng-38. 12p. Dep. NTIS.

Boiling in the core of Liquid Metal Fast Breeder Reactors can be detected by either of two principal methods, acoustic or neutron monitoring. Literature through June 1967 concerning acoustic methods is summarized. In the acoustic monitoring method for boiling detection, either acoustic waveguides or high-temperature acoustic sensors are recommended. 58 references. (auth)

1907 (EUR-4493) CONSEQUENCES OF THE RUPTURE OF A PRESSURE TUBE OR OF A COMPLETE CHANNEL IN AN ORGEL-TYPE REACTOR. Final Report. Holtbecker, H.; Montagnani, M.; Verzeletti, G. (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). 16 Jan 1970. 208p. Dep. NTIS (U. S. Sales Only). EUR FF 30.60.

The problems raised by the failure of an organic liquid cooled channel in the heavy-water-moderated reactor ESSOR are analyzed. The test rig, consisting of a 1:1 scale model of the vessel, connected to an organic-liquid circuit capable of delivering, when the channel fails, the same throughput of escaped coolant as would occur in actual operational failure is described. The results are given of the variously obtained measurements of the mechanical effects of the pressure waves generated by decompression of the coolant at the moment of the channel failure, by evaporation of the organic liquid and by the formation and collapse of steam bubbles

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created by the heat exchange between the organic liquid and the water. Thermal stress calculations are presented. 8 references. (auth)

1908 (HMI-B-99) CHEMICAL ASPECTS OF REACTOR SAFETY (LITERATURE REVIEW). 4. REPORT IN THE MISSION OF THE FEDERAL MINISTRY FOR DEVELOPMENT AND SCIENCE. Hoinkis, E. (Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany)). Jul 1970. 85p. (In German). Dep. NTIS (U. S. Sales Only).

Papers related to chemical problems of nuclear reactors are reviewed for the period from July 1968 to June 1969. Chemical aspects of safety are discussed under the general areas of: (1) release and transport of fission products; (2) aerosol behavior; (3) chemical reactions of metal cladding; (4) oxidation of graphite and coated particles; (5) chemical reactions of fuel; (6) adsorption of fission products on metals and graphite; (7) fission product transport in gas cooled reactors; (8) chemical problems of sodium loops; and (9) corrosion in water cooled reactors. 253 references. (H.D.R.)

1909 (IN-1348) EXPERIMENTAL INVESTIGATIONS OF REACTOR SYSTEM BLOWDOWN. Brockett, G. F.; Curet, H. D.; Heiselmann, H. W. (Idaho Nuclear Corp., Idaho Falls). Sep 1970. Contract AT(10-1)-1230. 50p. Dep. NTIS.

The purpose of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project is to obtain experimental information describing the hydraulic, thermodynamic, and mechanical behavior of a simulated reactor system during loss of coolant for use in evaluating analytical models and codes for reactor safety assessment. The need for experiments to test the analysis development, the need for experimental data to answer specific questions unique to current 1000 megawatt pressurized water reactor (PWR) designs, and the need for experimental data to answer specific questions arising in applying LOFT results to large power reactors are analyzed. The experimental facilities, instrumentation, and measurements are described and the experimental results are presented and discussed. The subcooled behavior typifying that of the PWR systems is discussed prior to the two-phase behavior typifying the two-phase decompression phenomena of the PWR and boiling water reactor (BWR) systems. The results are described in relation to the fundamental phenomena that are expected and prescribed by analysis, the specific need for experimental evaluation of an analysis area, and the empirical needs of the analysis development for large systems. Implications of certain of the results to large power reactors and the effects of scaling are commented on in selected cases. 18 references. (auth)

1910 (IN-1393) SEMISCALE BLOWDOWN AND EMERGENCY CORE COOLING (ECC) PROJECT TEST REPORT: TESTS 822 AND 823. Olson, D. J.; Whitbeck, J. F. (Idaho Nuclear Corp., Idaho Falls). Oct 1970. Contract AT(10-1)-1230. 58p. Dep. NTIS.

The preliminary test results of two decompression experiments (Tests 822 and 823) performed in the Semiscale Blowdown and Emergency Core Cooling (ECC) Project are presented. The purpose of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project is to provide the experimental data base required for the development and assessment of analytical models for the prediction of the thermal-hydraulic behavior occurring in a large PWR during a loss-of-coolant accident (LOCA). Tests 822 and 823 were initiated by hot leg breaks of a system configuration that includes both an operating loop and a simulated core with internals. The break size in Test 822 was 30% of the pipe area (0.027 ft^2), and the break size in Test 823 was 100% (0.09 ft^2). The measurements obtained provided information on fluid conditions as a function of time including quality, velocity, and mass flow rate as well as subcooled pressure loads throughout the loop and thrust measurements on the vessel. 4 references. (auth)

1911 (MRR-66) ZOCO II: A COMPUTATIONAL MODEL FOR CALCULATION OF THE DYNAMIC PRESSURE BUILDUP IN CONTAINMENT SYSTEMS OF LARGE, WATER-COOLED POWER REACTORS. Brosche, D. (Technische Hochschule, Munich (West Germany). Institut fuer Mess- und Regelungstechnik). Dec 1969. 39p. (In German). Dep. NTIS (U. S. Sales Only).

The ZOCO II code calculates the dynamic pressure buildup in containment systems following a break in the primary cooling system. In comparison to ZOCO I, computer model ZOCO II contains several additions. Number as well as possibility of connections of pressure zones can be selected arbitrarily within limits of the computer memory. Within the pressure zone, steam can be either saturated or superheated. The cross section for flow between various pressure zones can be time-dependent. Thus, valves and other closure devices can be included in the computation. (H.B.G.)

1912 (ORNL-NSIC-78) COMPILATION OF NATIONAL AND INTERNATIONAL NUCLEAR STANDARDS (EXCLUDING U. S. ACTIVITIES). 6th Edition, 1970. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 129p. Dep. NTIS.

All known national and international nuclear standards activities are tabulated. Standards activities of all national organizations, technical societies and government agencies are listed alphabetically by country. Standards activities are included for: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hungary, India, Israel, Italy, Japan, Netherlands, Norway, Pakistan, Republic of South Africa, Spain, Sweden, United Kingdom, and Yugoslavia. International organizations activities include: Bureau Veritas, European Organization for Nuclear Research, European Atomic Energy Community, Food and Agriculture Organization, Intergovernmental Maritime Consultative Organization, International Air Transport Association, International Atomic Energy Agency, International Commission on Radiation Units and Measurements, International Commission on Radiological Protection, International Electrotechnical Commission, International Labor Organization, International Organization for Standardization, Lloyd's Register of Shipping, Organization for Economic Cooperation and Development, United Nations, World Health Organization, and World Meteorological Organization. 17 references. (D.C.C.)

1913 NUCLEAR TECHNOLOGY AND RADIATION PROTECTION. Tech. Ueberwach.; 11: 185-96(1970). (In German).

The activities of the VdTUEV are reviewed for the period 1968/69 in the following fields: legal basis and atomic law; safety examination for nuclear reactors; Institute for Reactor Safety (IRS); reactor pressure vessels; working groups for nuclear techniques; rules for nuclear techniques, especially standards; and radiation protection, including monitoring of hot fallout particles. (INIS)

1914 HIGH-TEMPERATURE THORIUM REACTOR: ADVANCED CONCEPTS OF SAFETY. Baust, Emil; Zimmermann, Anton; Oehme, Helmut; Roehler, Erhard (Brown Boveri/Krupp Reaktorbau GmbH, Mannheim, Ger.). Brennst.-Waerme-Kraft; 22: 427-9(Sep 1970). (In German).

The helium-cooled high-temperature thorium reactor uses spherical fuel elements. The significance of the AVR pilot plant with an electrical output of 15 MW and of the 300 MW prototype for this family of reactors is discussed. Power plants of this type with a capacity between 600 and 1200 MW(e) are economically feasible. The advanced safety concepts which are applied in the prototype to control the release of activity, the safety in the pre-stressed concrete pressure vessel, and the concepts related to shut-down and subsequent heat dissipation are described. 8 references. (auth)

1915 RELEASE OF GASEOUS ACTIVITIES BY NUCLEAR POWER PLANTS. Hoertner, H. (Oesterreichische Studiengesellschaft fuer Atomenergie GmbH, Seibersdorf, Austria). Elektrotech. Maschinenbau; 87: 156-61(Mar 1970). (In German).

The various types of gaseous activities occurring in water- and gas-cooled nuclear power plants are discussed. The amounts of activities which are released into the atmosphere by different typical nuclear power plants are compared. Special attention is paid to the European light-water reactors. Finally the radiation burdens of persons are outlined which are caused by released activities. (auth) (INIS)

Power Conversion Systems

Refer also to abstracts 308 and 1034.

1916 DESIGN OF STEAM GENERATORS FOR A HIGH TEMPERATURE NUCLEAR POWER PLANT. Hansen, Ulf (Kernforschungsanlage, Juelich, Ger.). Brennst.-Waerme-Kraft; 22: 421-6(Sep 1970). (In German).

The methods for the design and investigation of stable load conditions of steam generators in high temperature reactors using a digital computer are described. The model discussed is for an installation consisting of pre-heater, evaporator, superheater, reheater, high pressure turbine and the most important control loops. Some possibilities of such a computer program are demonstrated with reference to a design variation of the THTR nuclear power station. The "Medea" program computes the points of stability under partial load conditions for any value of the steam generator input variables, and the stability characteristics of individual tubes. 9 references. (auth)

1917 PROBLEMS OF WATER SEPARATION IN WET-STEAM TURBINES. Gloger, Meinrad (Kraftwerk Union, Ruhr, Ger.) Brennst.-Waerme-Kraft; 22: 417-20(Sep 1970). (In German).

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During the expansion in wet-steam turbines of nuclear power-plants, steam partly condenses. The condensate diminishes the turbine efficiency and is responsible for blade erosion. The possibilities of the water-removal inside and outside the turbine casings are discussed. 11 references. (auth)

Research and Test Reactors

Refer also to abstracts 386, 726, 1848, and 1851.

1918 (ANL–7695) EXPERIMENTAL RESULTS FOR ZPR-3 ASSEMBLIES 58 AND 59. Stevenson, J. M.; Gasidlo, J. M.; Rogers, V. C.; Simons, G. G.; Vosburgh, R. O. (Argonne National Lab., Ill.). Apr 1970. Contract W-31-109-eng-38. 41p. Dep. NTIS.

Results of measurements made on ZPR-3 Assemblies 58 and 59 are presented. These assemblies had a simple Pu-graphite cell and differed in the reflector, which was depleted U (in Assembly 58) or Pb (in Assembly 59). Critical mass, fission-rate and perturbation distributions, central fission ratios, central perturbations, the Doppler reactivity effect in a natural UO_2 sample, and the central neutron spectrum by the proton-recoil method are presented. Some of the experiments were performed in both assemblies, others in only one. 24 references. (auth)

1919 (BNWL–1498) FFTF HYBRID COMPUTER SYSTEM. Busness, K. M. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Sep 1970. Contract AT(45-1)-1830. 65p. Dep. NTIS.

A hybrid computer system has been developed to augment the simulation studies and design effort for the Fast Flux Test Facility. A Digital Equipment Corporation PDP-9 digital computer and Applied Dynamics/Four analog computer were interfaced by means of high speed analog-to-digital and digital-to-analog conversion equipment. A control interface was developed to provide digital control of analog/hybrid functions. 5 references. (auth)

1920 (DOCKET-50184–23) NATIONAL BUREAU OF STANDARDS REACTOR. Request for Waiver and Increase of Discharge Limit to Ten Curies. (National Bureau of Standards, Washington, D. C.). 30 Oct 1970. 1p. Dep. NTIS.

1921 (EUR–4416) THE OPERATIONS GROUP OF THE BR-2 REACTOR AND ITS ASSOCIATED FACILITIES. Annual Progress Report, 1968. (European Atomic Energy Community. Centre d'Etude de l'Energie Nucleaire, [Mol] (Belgium)). 7 Nov 1969. 34p. Dep. NTIS (U. S. Sales Only). EUR FF 5.60.

The operation of the BR-2 reactor and its associated installations is carried out under the contract of association signed between Euratom and the CEN, in 1960, and valid for the period of 20 years. The reactor and its facilities are operated jointly by the two partners for their own purposes: each may however make the facilities available to other parties for irradiation experiments. A steering committee, on which Euratom and CEN are represented in equal numbers, directs and coordinates the programs and the plant operation; this committee met six times during the year 1968. Since 1963, the operation has clearly demonstrated the continuing and ever increasing interest in the use of the reactor, especially since the flexibility of the operation permits the new and varied demands of the experimenters to be met easily. During 1968, increased support was again given to the large nuclear projects within the community, while still permitting irradiation programs for non-member states to be carried out. (auth)

1922 (GEAP–10010-25) SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM. Quarterly Report No. 25, May–July 1970. Pflasterer, G. R.; Becker, R. A. (comps.) (General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation). Aug 1970. Contract AT(04-3)-540. 70p. Dep. NTIS.

SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR—fuel assemblies for, fabrication of instrumented
—startup testing of plutonium oxide (PuO_2)–uranium oxide (UO_2) fueled, (E/T)
—physics measurements for, (E/T)
—maintenance during May to July 1970
—operation during May to July 1970 (D.C.C.)

1923 (KFK–1188) ARRANGEMENT AND FUNCTION OF THE ON-LINE SYSTEM FOR DATA ACQUISITION AND EXPERIMENT CONTROL FOR SNEAK. van Velze, P.; Walze, H. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik). May 1970. 55p. (In German). (EUR–4305). Dep. NTIS (U. S. Sales Only).

On-line computer applications in the field of nuclear reactor experiments are described. A technical description of the installation for computerized data acquisition and experiment control at the fast zero power reactor SNEAK is given. The main part of the system consists of a third generation type 24 bit-computer in DTL technique. Its core memory has a capacity of 16 K words. Typical applications are the calibration of the reactor control rods, material worth measurements, axial and radial fission rate traverses, neutron spectroscopy and automatic tests of experimental equipments. The on-line system has been found to be more reliable than the method utilized before which was based upon data acquisition with punched paper tapes and off-line reduction of experimental data. (auth)

1924 (LA–4473) HEAT LOSS FROM FUEL ELEMENTS PARTIALLY IMMERSED IN WATER. Wenzel, R. G.; Arnold, G. P. (Los Alamos Scientific Lab., N. Mex.). Jun 1970. Contract W-7405-eng-36. 6p. Dep. NTIS.

Fuel-plate temperatures of inductively heated simulations of the aluminum MTR-type fuel elements used in the Omega West reactor have been measured as a function of power input and plate immersion depth in water. At immersions $\lesssim$5 in., the primary cooling mechanism is production and superheating of steam. A much more efficient cooling mechanism, percolation, becomes dominant at immersions $\gtrsim$5 in. Percolation carries liquid water directly up into the cooling channels and cools so effectively that increased input power decreases plate temperature, within the range of input power ($\leq$5.1 kW) available. (auth)

1925 (N–70-26979) EFFECT OF ADDING LITHIUM NITRIDE, HAFNIUM, TANTALUM, AND TUNGSTEN TO A FAST-SPECTRUM, MOLYBDENUM-REFLECTED CRITICAL ASSEMBLY. Anderson, John L.; Mayo, Wendell (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). May 1970. 20p. (NASA-TM-X–52787; E–5641). NTIS.

The change in fuel loading requirements and the resulting neutron energy spectrum are calculated when LiN, Hf, Ta, and W are added to the fast spectrum critical assembly. The assembly is designed to be a simulation of a conceptual fast reactor cooled by Li, fueled with ^{235}UN and reflected by Mo. (auth) (STAR)

1926 (N–70-27514) DESIGN GUIDES FOR IRRADIATION EXPERIMENTS WITH FAST SPECTRUM REACTOR FUEL ELEMENTS IN THERMAL TEST REACTORS. Anderson, John L. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). May 1970. 24p. (NASA-TM-X–2012; E–5160). NTIS.

Multigroup calculations provide a comparison of various techniques for simulating the effects of a fast reactor spectrum during the irradiation of fueled experiments in thermal test reactors. Spectral requirements are met by thermal flux spectra that are modified by removing thermal neutrons with Cd and/or ^{10}B absorbers. Power profile requirements in fueled samples are met by reducing the ^{235}U enrichment and/or reducing the sample size. (auth) (STAR)

1927 (N–70-35911) PULSED-NEUTRON-SOURCE STUDIES WITH THE NASA ZERO POWER REACTOR II. Fox, Thomas A.; Mueller, Robert Q.; Fieno, Daniel (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Aug 1970. 31p. (NASA-TN-D–5956; E–5659). NTIS.

An experimental and analytical study of the pulsed-source technique for measuring shutdown reactivities was made using the Zero Power Reactor II over a wide range of fuel solution concentrations for configurations varying from delayed critical to highly subcritical. The fuel is an aqueous solution of enriched uranyl fluoride. Calculated fundamental prompt-model decay constants obtained using one-dimensional multigroup transport theory are compared to experimental values. Also, calculated values for the subcritical reactivity are compared with values derived from experiments using an inhour technique, the technique of Simmons and King, and the three well-known area-ratio techniques of Garelis and Russell, Gozani, and Sjostrand. (auth) (STAR)

1928 (ORNL–TM–3161) OAK RIDGE RESEARCH REACTOR QUARTERLY REPORT, APRIL–JUNE OF 1970. Tabor, W. H.; Hurt III, S. S. (Oak Ridge National Lab., Tenn.). 10 Sep 1970. 42p. Dep. NTIS.

The ORR operated satisfactorily throughout the quarter, with a minimum of downtime and only minor operating difficulties. The average power level for 89.9% of the time was 30.0 MW(t). Fuel utilization continued to be satisfactory, with a current average burnup of 49.4%. Shim rods containing 168 g of ^{235}U (rather than 154 g, as previously constructed) were introduced into the core with satisfactory results. This change should reduce fuel costs because only one alloy will be needed in the construction of all the ORR fuel elements. One tube in the all-aluminum pool heat

exchanger was plugged after it was discovered to be leaking. Additional maintenance to the process systems was rather routine in nature. The inlet to the syphon-break system (equalizer line) was equipped with a strainer to prevent the entrance of foreign material which could plug the pipe. Following the installation, the system was checked and found to be operating as designed. (auth)

1929 (RCN–122) STEK: THE FAST-THERMAL COUPLED FACILITY OF RCN AT PETTEN. A Collection of Reports Describing the Status of the Facility, the Program, and the Experiments, as of February 1970. (Reactor Centrum Nederland, Petten). 185p. (CONF-700217; EURFNR–821).

Work Performed under United States–Euratom Fast Reactor Exchange Program.

Included are 9 papers on various aspects of the STEK facility and the program for integral measurements of fission product cross sections in fast reactor spectra. A separate abstract was prepared for each paper. (H.D.R.)

For abstracts of individual papers see: 1930–1938.

1930 (RCN–122, pp 1-52) STEK: THE FAST-THERMAL COUPLED CRITICAL FACILITY OF RCN AT PETTEN. Bustraan, M.; Coehoorn, J.; Veenema, J. J. (Reactor Centrum Nederland, Petten).

In the autumn of 1967 it was decided to convert the existing, heavily shielded, light water critical experiment KRITO into a coupled fast-thermal system, in the fast zone of which by oscillator methods integral cross sections of actual fission product-mixtures, -elements and -nuclides are to be measured. After completion of its construction early May 1969 in the new facility STEK (Fast Thermal Experiment in KRITO) first a thermal, Argonaut type, core was build-up by loading of graphite elements in the central zone and fuel elements in the thermal zone. A few months were used to test the facility and oscillator equipment and, at the end of 1969, the graphite in the central zone was successively replaced by fast fuel elements until the first coupled fast-thermal STEK core (type STEK 4000) was obtained. This core is used for oscillator measurements with a mixed fission product sample made from highly irradiated fuel plates from the High Flux Reactor (H.F.R.). The argumentation is given of the STEK design concept in the light of a discussion of the influence of the inaccuracies of cross sections of fission products on fast reactor parameters. A description of the STEK facility and oscillator system is presented. Finally, the most important parameters of the first coupled core and the preliminary results of oscillator measurements with ^{10}B, ^{235}U and ^{12}C samples are reviewed. 15 references. (auth)

1931 (RCN–122, pp 53-65) USE OF LEAD AS BUFFER IN A FAST-THERMAL COUPLED SYSTEM. Bustraan, M. (Reactor Centrum Nederland, Petten).

In the course of the design of the fast-thermal coupled system STEK it was decided to use lead as buffer material between the fast and thermal zone. The arguments for this choice are given as a result of some calculations wherein lead is compared with natural uranium and iron as alternative buffer material. (auth)

1932 (RCN–122, pp 67-84) PROPOSED PROGRAM FOR THE MEASUREMENT OF INTEGRAL FISSION PRODUCT CROSS SECTIONS IN STEK. Heijboer, R. J.; Bustraan, M. (Reactor Centrum Nederland, Petten).

The motives are given for the choice of the fission product samples that will be measured in STEK. Two types of samples can be distinguished: integral samples and isotopic samples. The reactivity effects of the samples will be measured in a number of different spectra using a pile-oscillator technique. The measured values will be compared with calculated ones, so giving a check on existing microscopic cross section sets. Probably use will be made of statistical adjustment techniques to derive improved effective cross section sets. The measurement of the neutron spectra using different techniques is very important for the interpretation of the oscillator data. An outline is given of the experimental program. 12 references. (auth)

1933 (RCN–122, pp 85-105) STATISTICAL CONSIDERATIONS ON TECHNIQUES FOR ADJUSTMENT OF DIFFERENTIAL CROSS SECTIONS WITH MEASURED INTECRAL PARAMETERS. Dragt, J. B. (Reactor Centrum Nederland, Petten).

In the STEK experiment the effect of fission products in a fast reactor spectrum is measured. A cross section integrated over energy is obtained in this way. For reactor calculations one is usually interested in differential data, although the final interest always is in integral data. The impact of integral data on the differential data and the reactor parameters obtained from them are examined. The emphasis is on the elementary statistical aspects of the problem. Two different approaches are given. Some of the points made in the two methods are illustrated with an example for a situation simple enough to allow analytical solutions. Special problems and possibilities in the adjustment of fission product cross sections are mentioned shortly. 8 references. (auth)

1934 (RCN–122, pp 107-19) TIME-OF-FLIGHT EXPERIMENT AT STEK. Tuyn, J. W. N. (Reactor Centrum Nederland, Petten).

The zero-energy fast-thermal coupled reactor STEK will be equipped with a time-of-flight experiment in order to measure the neutron energy spectra of the fast inner zone. Since a short reactor pulse is required, the graphite around the fast zone will be removed during the experiments. The pulsed source for the time-of-flight equipment consists of a 14 MeV SAMES type T400 neutron generator with duoplasmatron ion source. An evacuated flight tube of 50 m will be used. The well-shielded neutron detector, movable inside the tube, consists of a bank of ^{6}Li-glass scintillators. Time-of-flight neutron spectrum measurements will be performed at 10, 30 and 50 m from the core center. With this experimental setup the neutron energy spectra will be measured for the different energy ranges of the STEK cores. According to the time-schedule the spectrum measurements will start at the end of 1970. A brief description of the experimental setup is presented. (auth)

1935 (RCN–122, pp 121-45) CALCULATIONS ON THE TIME VARIATIONS OF SPACE AND ENERGY DEPENDENCE OF THE NEUTRON FLUX IN A SUBCRITICAL FAST REACTOR. Oei, T. D. (Reactor Centrum Nederland, Petten).

For the interpretation of the STEK pulsed neutron source experiments for the reactivity measurements and time-of-flight experiments, the investigation of the time variation of space and energy dependence of the neutron flux in a fast subcritical core was felt to be necessary. A time-dependent two-dimensional diffusion calculation code was used. Also a one dimensional inhomogeneous diffusion calculation was used to study the time-averaged spectra of the flux during its decay. Conclusions can be drawn from such calculations about the quality of comparison between the calculated static reactivity and the reactivity found from pulsed neutron source experiment. Also, conclusions can be drawn about resolutions which can be obtained in time-of-flight experiments and the possible improvements when resolution correction is applied. For these studies it is important to distinguish the several different spectra which are defined. Examples of calculations are given with a few preliminary results of experiments. 9 references. (auth)

1936 (RCN–122, pp 147-56) COMPUTER PROGRAM FOR THE SOLUTION OF THE TWO-DIMENSIONAL TIME-DEPENDENT MULTIGROUP DIFFUSION EQUATIONS. Heijboer, R. J. (Reactor Centrum Nederland, Petten).

A description is given of the code TEDDI-T, which solves the time- and space-dependent multigroup diffusion equations in two dimensions. This program can be used for the calculation of the time dependent neutron spectrum in a pulsed subcritical reactor. 11 references. (auth)

1937 (RCN–122, pp 157-65) keV NEUTRON SPECTROMETRY BY PROTON RECOIL TECHNIQUE. Mos, A. P. J.; Montizaan, J. (Reactor Centrum Nederland, Petten).

A description is given of the proton recoil spectrometer developed for neutron spectrometry, especially the keV-range, of the spectra in the STEK-facility. In this energy range the use of a neutron-gamma discrimination is necessary. The features of the new discrimination technique are outlined and a short description of the electronic circuitry used is given. Specific ionization spectra down to a few keV, measured with this spectrometer in a degraded fission spectrum, are presented. Finally, some details are given concerning the connection of the spectrometer to the P9202 on-line computer. The on-line computer is used in this configuration as a flexible two-parameter multichannel analyzer. After the measurement it performs a data reduction. (auth)

1938 (RCN–122, pp 167-85) EXPERIENCES WITH AN ON-LINE REAL-TIME COMPUTER AT STEK. Dragt, J. B. (Reactor Centrum Nederland, Petten).

For several measurements to be carried out in the STEK-experiment the use of a small on-line digital computer appeared to be appropriate. The computer had to be very fast in order to meet the requirements for some experiments with a fast reactor core. For these experiments a Honeywell DDP-516 (Philips P9202) computer was selected and installed. Experimental interfaces were built in the CAMAC-system. A brief description is presented of the data treatment and the experiences obtained with some experiments, which are representative of the potentialities of digital computers for on-line real-time analysis of fast reactor physical experiments. 15 references. (auth)

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1939 (SRARI-P-69) THE INVESTIGATION OF RADIATION ENERGY RELEASES IN THE EXPERIMENTAL CHANNELS OF THE SM-2 REACTOR. Veselkin, A. P.; Neverov, V. A.; Fomenko, A. P.; Tsykanov, V. A.; Shchipakin, O. L. (Scientific Research Atomic Reactor Inst., Melekess (USSR)). 1970. 33p. (In Russian). Dep. NTIS. (U. S. Sales Only).

The experimental values of radiation energy releases in specimens placed into CM-2 reactor channels are compared with calculated ones obtained with "Gamma-2" program realizing Monte Carlo method. As a result of the calculation technique which simulates the actual arrangement of CM-2 reactor channels satisfactorily, agreement is obtained between experiment and calculation. 8 references. (auth)

1940 BESTRAHLUNGSTECHNIK AN FORSCHUNGSREAKTOREN. (Irradiation Technique at Research Reactors). Marth, Willy. Thiemig-Taschenbuecher, Band 13. Munich; Verlag Karl Thiemig KG (1969). 222p. DM 16,80.

More than 10,000 irradiations in German research reactors are performed annually for physics, chemistry, biology, medicine, and other fields of applied research. All important scientific, technical, economic, and legal questions concerning such irradiations are discussed for reactors in Germany and adjacent countries as well. The information is directed to persons who intend to utilize reactor radiation for research purposes. Personnel of reactor stations are given answers to frequent questions posed by customers. (H.B.G.)

1941 GADOLINIUM FILTER FOR THERMAL NEUTRONS. Borchardt, G. (Kernforschungsanlage, Juelich, Ger.). Atomkernenergie; 15: 311(1970). (In German).

In the reactor FRJ-2, the epithermal neutron flux was compared for cadmium and gadolinium filters and measured by neutron activation of cobalt probe. Gadolinium could be used beyond the thermal limit of cadmium (321°C) up to temperatures in excess of 900°C. Because of its significantly larger cross section, 0.1 mm gadolinium corresponds to 1 mm of cadmium. The measured flux values are presented. (H.B.G.)

1942 CONJUGATED HEAT TRANSFER PROBLEM AND PROBLEM OF OPTIMAL CONTROL OF UNSTEADY-STATE THERMAL PROCESS IN NUCLEAR REACTORS. Ermakov, V. S.; Zaluzhnyi, G. I.; Edinovich, A. A. (Power Engineering Inst., Minsk). Inzh.-Fiz. Zh.; 19: 243-51(Aug 1970). (In Russian).

Considered are a conjugated heat transfer problem and problem of optimal control of unsteady-state thermal process in swimming-pool reactors. Unsteady-state heat transfer was chosen to be controlled, and the reactivity and heat transfer agent velocity, as governing functions. The governing functions have been analyzed in two cases: when the reactivity changes linearily, and when the reactivity changes arbitrarily. 12 references. (auth)

Rocket and Space Reactors

1943 (N-70-32250) PRELIMINARY DESIGNS OF SPACE POWER NUCLEAR REACTOR SHIELDS. Kaszubinski, Leonard J.; Kacher, Henry F.; Odar, Fred (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Jul 1970. 51p. (NASA-TM-X-2038; E-5457). NTIS.

Preliminary designs of two 4 π shield configurations for a SNAP-8 mercury Rankine cycle power system are presented. The shield materials are lithium hydride, tungsten alloy, and depleted uranium. The nuclear heat generated in the shields is discussed and methods of rejecting this heat are suggested. Layout drawings are included that show structural details. A detailed weight breakdown is given for both shields. The number and sizes of the shield penetrations are given. Several problem areas are identified. (auth) (STAR)

1944 (N-70-33276) COMPARISON OF EXPERIMENTAL AND CALCULATED CRITICAL MASSES FOR A GAS CORE CAVITY REACTOR. Gumto, Klaus H. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Jul 1970. 22p. (NASA-TM-X-2055; E-5320). NTIS.

Experimental critical masses for a cylindrical cavity reactor with simulated gaseous fuel are compared with calculated critical masses for similar reactor configurations. Both diffusion and one- and two-dimensional transport theory computer codes were employed in five distinct sets of calculations. By varying input parameters such as number of broad energy groups and number of mesh intervals from one set to another, the effect of the changes on the accuracy of the calculations was determined. (auth) (STAR)

1945 (N-70-34304) EXPERIMENTAL EVALUATION OF A SNAP-8 TURBINE-ALTERNATOR. Boecker, Fred (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Jul 1970. 32p. (NASA-TM-X-252865). NTIS.

The steady-state performance of a SNAP-8 turbine-alternator was evaluated as part of an investigation of system startup characteristics. The turbine-alternator accumulated 157 hours and was subjected to 135 startups and shutdowns. During the test series, alternator power was varied from 49 to 66 kilowatts at system design mercury flow rate of 12,000 lbm/hr. The minimum alternator power obtained at system self-sustaining mercury flow of 6600 lbm/hr was 21 kilowatts. The large number of startups and shutdowns of the turbine-alternator did not result in degradation in performance or operating characteristics. (auth) (STAR)

1946 NUCLEAR ROCKET. Spaceflight; 12: 390-4(Oct 1970).

A major increase in specific impulse for rocket vehicles will come from the nuclear rocket. The first generation nuclear rocket engine, NERVA (Nuclear Engine for Rocket Vehicle Application), will provide approximately twice the specific impulse of chemical rockets. The nuclear rocket will be able to move large payloads from low Earth orbit to geo-stationary orbit or to lunar orbit to support extended lunar exploration. It also offers major advantages for transporting heavy payloads into deep space, allowing an initial doubling of payload weight for deep space missions. Journey times to the regions of Jupiter and Saturn would be cut to 2 or 3 years, respectively. Together with these advantages, it would also be possible to stop and restart large nuclear engines at will, with great reliability and safety. (auth) (UK)

Process Heat and Desalination Reactors

Refer also to abstract 1805.

1947 CALCULATION OF CHEMONUCLEAR REACTOR CHANNEL PRODUCTIVITY IN CONDITION OF NON-ISOTHERMAL FLOW OF RADIOLIZED GAS AND VARIABLE DOSE RATE. Dzantiev, B. G.; Kazazyan, V. T.; Krasin, A. K.; Nichipor, G. V. At. Energ. (USSR); 29: 71-6(Aug 1970). (In Russian).

The main characteristics defining radiation chemical reactions are considered using as a model process the radiolysis of gaseous NH_3. The results obtained allow evaluation of the productivity of a given chemonuclear reactor as to the desired products as well as showing means of increasing productivity. (9 references) (auth)

Marine and Portable Power Reactors

Refer also to abstract 1808.

1948 (DOCKET-50238-73) N. S. SAVANNAH. Facility License No. NS-1, Amendment 7. Transfer Authority to Operate the Nuclear Reactor from FAST to MARAD. (Division of Reactor Licensing (AEC), Washington, D. C.). 9 Nov 1970. 101p. Dep. NTIS.

1949 PROCHNOST' SUDOVYKH YADERNYKH REAKTOROV. (Strength of Maritime Nuclear Reactor Vessels). Samsonov, Yu. A. Leningrad; Izdatel'stvo Sudostroenie (1970). 264p.

Methods for calculation of the strength of reactor vessels and their application to marine reactor operating conditions are presented. Essential information necessary for the calculation of stresses in vessel elements is discussed, and generalized theoretical and experimental results of stresses near vessel penetrations are compared. Emphasis is placed on considerations of material resistance to creep, embrittlement, and fatigue and on factors of material selection not concerned with strength. 35 references. (tr-auth)

1950 PRESENT STATUS AND PROBLEMS ENCOUNTERED DURING DEVELOPMENTAL WORK ON NUCLEAR SHIP PROPULSION. Nippon Genshiryoku Gakkaishi; 12: 586-96(1970). (In Japanese).

The reports of research and developmental work performed in nuclear propulsion for merchant vessels are evaluated. The aspects of the work reviewed include the general design of the ship hull, the integrated once-through boiler adopted in the ship for its promise of providing a compact marine reactor, safety

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assessment with reference to corresponding studies made for the Savannah, the effect of ship movement on the hydro-thermal characteristics of the reactor, shielding problems, and the effect of radiation on the strength of pressure vessel materials. Reports on the test and operation obtained on the Savannah and Otto Hahn were also studied. Available information on the general status of nuclear applications to space research published by NASA (USA) was further scanned. A comprehensive examination was made of the present status and future aspect of nuclear marine propulsion. (27 references) (auth)

Production Reactors

1951 (DUN-SA-153) SOME ASPECTS OF SYSTEM SAFETY RELATED TO NUCLEAR POWER. Crosetti, P. A. (Douglas United Nuclear, Inc., Richland, Wash.). 8 Oct 1970. 11p. (CONF-701013-1). Dep. NTIS.

From Meeting of the System Safety Society, Seattle, Wash.

Environmental considerations given to the radioactive and thermal effluents from nuclear power plants are analyzed. Safety aspects concerning the Hanford N Reactor are discussed. Requirements for power reactor engineered safeguards and protection systems are described. (D.C.C.)

1952 XENON OSCILLATION EXPERIMENTS IN A PRODUCTION REACTOR. Topp, S. V.; Byars, R. F.; Germann, R. P. (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucl. Sci. Eng.; 42: 239-54(Nov 1970).

Xenon oscillation experiments were performed for the purpose of checking computer programs for calculating the oscillation effects. Reliable methods of analysis are needed by designers of large power reactors to help determine the economic consequences of operating under these conditions. Calculations were made at Savannah River before the experiments began, as an operational guide only; and, as each experiment was done the next experiment was designed, based largely on past results and very little on the calculations. The computer programs used, the relevant input parameters, agreement between experiment and calculation, and some comments regarding the problems with one-dimensional calculations are given in detail. (auth)

Reactor Theory

1953 (JAERI-1194) STUDY FOR DECAY CHAIN OF FISSION PRODUCTS. Report of the Fission Products Working Group, No. 1. Sakata, Hajime; Nagayama, Satoshi; Otake, Iwao (Japan Atomic Energy Research Inst., Tokyo). Apr 1970. 49p. (In Japanese). Dep. NTIS (U. S. Sales Only).

Concerning the burnup analysis in a thermal reactor system, the multi-group constants of the fission products (FPs) have been studied on the following items: (1) nuclear data of FPs, such as thermal fission yield, decay constant, thermal neutron absorption cross section, and resonance integral; (2) decay chain of FPs nuclides; (3) production of the calculation code, FP CHAIN, for the decay chain analysis; (4) buildup amounts of FPs at the exposure stages of 10^{12}, 10^{13} and 10^{13} and 10^{14} n/cm^2 sec. Based on the results of the present chain calculations with about 300 fission product nuclides, production of the multi-group constants for the pseudo fission products should be performed in the next step of investigation. 41 references. (auth) (Japan)

Kinetics

Refer also to abstracts 1870 and 1942.

1954 (BNWL-1509) RESONANCE CROSS SHIELDING IN REACTOR ANALYSIS. Kidman, R. B.; Lindenmeier, C. W.; Schenter, R. E. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jul 1970. Contract AT(45-1)-1830. 35p. Dep. NTIS.

Accidental overlap between the resonances of distinct isotopes is ignored in the present structure factor method. To ascertain the effect of accidental overlap and to develop possible modifications of the structure factor method, the specific overlap between Pu-239 and U-238 is analyzed. The basic approach was to modify ETOX subroutines enabling them to generate "cross shielded" f-factors that account for self shielding and accidental overlap. A comparison between the cross shielded and the normal self-shielded f-factors then reveals any accidental overlap effects. Significant overlap effects were not detected between resolved and unresolved resonances nor between unresolved and unresolved resonances. However, effects as large as 6% resulted from the overlap between the resolved resonances of U and Pu. 4 references. (auth)

1955 (KFKI-70-13-RPT) SISYPHUS: A CODE FOR THE SOLUTION OF FEW-GROUP DIFFUSION EQUATIONS IN TWO DIMENSIONS. Szatmary, Z.; Vigassy, J. (Magyar Tudomanyos Akademia Kozponti Fizikai Kutato Intezete, Budapest). [1969]. 13p. Dep. CFSTI (U. S. Sales Only).

A computer code which solves the few-group diffusion equation in two-dimensional (X-Y and R-Z) geometries using the method of finite differences is described. This is a criticality code for the determination of the smallest eigenvalue ($\lambda = 1/k_{eff}$) and the corresponding eigenfunction. As a by-product of the solution of the diffusion equation, the code calculates various reaction rates in the reactor. Several options are available to the user, including type of boundary condition and possible symmetry properties. SISYPHUS is an ICL-1905 code which requires at least a paper tape reader and line printer. Additional peripherals which may be required (depending on the complexity of the problem considered) are a second paper tape reader, a paper tape punch, and up to three scratch magnetic tapes. (R.W.R.)

1956 (MRR-60) ANALYTICAL MODEL FOR INVESTIGATION OF THE DYNAMIC BEHAVIOR OF PRESSURIZED-WATER REACTORS WITH SELF-MAINTAINED PRESSURE. Jaschek, H.; Neuenhahn, P. (Technische Hochschule, Munich (West Germany). Institut fuer Mess- und Regelungstechnik). Jul 1969. 49p. (In German). Dep. NTIS (U. S. Sales Only).

An analytical model is described and used to study the behavior of reactors for transients of various power levels. In combination with control devices, the computer model proved very suitable for predicting behavior of controlled reactor installations. (tr-auth)

1957 (MRR-69) METHOD FOR THE CALCULATION OF THE SPACE- AND TIME-DEPENDENT POWER DISTRIBUTION OF NUCLEAR REACTORS. Birkhofer, A.; Werner, W. (Technische Hochschule, Munich (West Germany). Institut fuer Mess- und Regelungstechnik). Sep 1969. 25p. (In German). Dep. NTIS (U. S. Sales Only).

In large power reactors, the application of point kinetics is questionable for determining flux distribution during transients. A new computer model for solution of non-stationary diffusion equations is developed. It permits calculation of the time-dependent flux distribution for various reactivity transients. It includes non-stationary neutron diffusion in two energy groups with delayed neutrons as well as temperature effects of fuel elements. The model is described in both one- and two-dimensional cylindrical geometry. (H.B.G.)

1958 CALCULATION OF LEAKAGE SPECTRA OF REACTORS WITH CYLINDRICAL HOLES. Rief, H.; Zech, H. J. (CCR-EURATOM, Ispra, Italy). Atomkernenergie; 16: 163-4(1970). (In German).

By means of Monte Carlo computations, the effect of cooling channels on multiplication factors, integral neutron loss, neutron spectrum in the core, and spectrum of neutrons leaking from the core was studied. It was concluded that empty cooling channels, in comparison with a homogenous arrangement, cause a significant change of the neutron balance. This effect depended strongly on core geometry. With respect to the neutron spectrum, however, empty channels had so little influence in the core and in the leakage flux that it generally could be neglected. (H.B.G.)

1959 FLUCTUATIONS FROM THE STEADY-STATE OF A REACTOR. 3. ON THE TIME REVERSIBILITY. Taniguchi, Akira (Tokai Univ., Tokyo); Sako, Okitsugu; Matsumura, Hiroshi. Tokai Daigaku Kiyo Kogakubu; No. 2, 33-7(Jun 1970). (In Japanese).

The fluctuations of neutrons and temperature and their power spectra are considered in the case where the time reversibility does not exist. It is shown that the condition of the time reversibility does not play the essential role in the fluctuation itself, especially in the critical fluctuation, but the essential condition for the existence of the steady-state moment at critical state is the non-linearity of the system. Some connection between the method presented and the usual Langevin method is discussed. Discussions on results are added. (auth) (Japan)

1960 OPTIMIZATION OF FUEL BREEDING IN REACTORS. Kuz'min, V. I.; Pupko, V. Ya. This paper was summarized in At. Energ. (USSR); 28: 47(Jan 1970) as paper No. 357/5279. (In Russian).

The variational problem of determining the maximum ω, the initial rate of increase of secondary fuel, for a constant value of k_{eff} is considered. Euler's equation from the calculus of variations

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is used to find the optimum radial distribution of ^{239}Pu in the core. The variations of the functionals ω and k_{eff} are determined by perturbation theory. The algorithm used in the numerical iteration method permits the redistribution of ^{239}Pu consistent with its effectiveness with respect to ω and k_{eff}, taking account of constraints on the ^{239}Pu concentration, and ensures the convergence of the solution. Computer calculations of the optimum ^{239}Pu concentrations were performed in the 18-group diffusion approximation for a reactor of the BN-350 type. (auth)

1961 PL/K METHOD FOR SOLUTION OF THE ONE-VELOCITY TRANSPORT EQUATION IN DOUBLY-PERIODIC LATTICES OF FUEL ELEMENTS. PART II. APPLICATIONS. Aviram, Ira (Nuclear Research Center, Beer-Sheva, Israel); Yeivin, Yehuda. J. Nucl. Energy; 24: 311-22(Oct 1970).

The theoretical model developed in Part I was used in a set of test calculations designed to investigate the effect of spatial mode (K) truncation on the scalar flux distribution and to compare the PL/K method with radially-symmetric, multigroup, S4 calculations. It is shown that the quality of K-truncation is primarily influenced by the altitude of discontinuity jumps in the piecewise constant cross section functions and by the number of points of discontinuity with alternate signs. Good agreement was obtained between cylindrical S4 and P5/7 calculations for a number of simple hexagonal cells with H_2O-moderated cylindrical UO_2 fuel elements. More complicated fuel configurations require higher K-approximations. A number of suggestions are offered for further improvement of the method. (auth) (UK)

1962 PL/K METHOD FOR SOLUTION OF THE ONE-VELOCITY TRANSPORT EQUATION IN DOUBLY-PERIODIC LATTICES OF FUEL ELEMENTS. PART I. THEORY. Aviram, Ira (Nuclear Research Center, Beer-Sheva, Israel); Yeivin, Yehuda. J. Nucl. Energy; 24: 289-310(Oct 1970).

Periodic solutions are derived for the one-velocity neutron transport equation in an infinite, doubly-periodic lattice of fuel elements inbedded in a moderating medium. The actual shape and composition of the fuel element and structural materials are taken into consideration. The angular flux is expanded in a complete set of spherical harmonics and a complete set of doubly-periodic spatial functions over the unit parallelogram of the lattice. The integrodifferential equation is thus transformed into an infinite linear algebraic system. For a specified "L/K approximation," the number of spherical harmonics and of periodic functions retained in the expansion is defined by L and K, respectively. The main features of the method are: (a) exact treatment of a number of common fuel configurations, such as concentric annuli, clusters, parallel plates; (b) inclusion of anisotropic scattering of any order; (c) common cell geometrics (square, hexagonal, triangular) are included as particular cases of the general parallelogram. (auth) (UK)

1963 CALCULATION OF HETEROGENEOUS FLUXES AND REACTIVITY WORTHS. Stacey, W. M. Jr. (Argonne National Lab., Ill.). Nucl. Sci. Eng.; 42: 233-6(Nov 1970).

An iterative perturbation method for calculating the change in eigenvalue between a heterogeneous and a homogeneous model of a reactor cell and for obtaining the spatial flux and importance distribution in the heterogeneous cell is extended to a similar, but more general, iterative solution technique derived in a variational theory context. Equations are given for the heterogeneous flux and adjoint when the cross sections and/or compositions, as well as the collision probabilities, vary between the reference model and the model of interest. When the reference model is homogeneous, certain normalizations can be introduced to greatly simplify the set of equations which must be solved for the heterogeneous flux and importance. (auth)

1964 COMPLETE EIGENVALUE SPECTRUM FOR THE NEUTRON WAVE PROBLEM IN MULTIGROUP DIFFUSION THEORY. Ghatak, A. K.; Bansal, N. K.; Singh, Om Pal (Indian Inst. of Tech., New Delhi). Nucl. Sci. Eng.; 42: 171-8(Nov 1970).

The complete eigenvalue structure and the corresponding eigenfunctions of the neutron transport operator for the neutron wave propagation through water and heavy water are investigated. The calculations have been performed in multigroup diffusion theory approximation using realistic scattering kernels. The results are found to be rather insensitive to the chemical binding effects. The bounds on the eigenvalues are also discussed and the results corresponding to the fundamental mode eigenvalue are compared with the experimental data for heavy water. Results show that there exist only one resolvable mode for water and four resolvable modes for heavy water. 18 references. (auth)

Dynamics

1965 (ORNL-TM-3198) OPTIMUM BINARY SIGNALS FOR FREQUENCY RESPONSE TESTING. Buckner, M. R. (Oak Ridge National Lab., Tenn.). Nov 1970. Contract W-7405-eng-26; Subcontract 2806. 124p. Dep. NTIS.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

An algorithm for generating multifrequency binary test signals with a prescribed distribution of signal power in selected frequencies was developed. The usefulness of these signals in dynamics studies of large multicomponent systems such as nuclear reactors was evaluated. The evaluation was made by performing numerically simulated and actual system dynamics tests using multifrequency binary signals as well as other periodic deterministic test signals. Particular attention was given to the effects of system noise and nonlinearities on such measurements. 40 references. (auth)

Experimental Applications

Refer also to abstracts 1867, 1869, and 1871.

1966 (BNWL-1501) PCTR MEASUREMENT OF k_∞ FOR A TUBULAR FUEL ELEMENT WITH INTEGRAL TARGET IN A WATER LATTICE. Bennett, C. L.; Oden, D. R. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jun 1970. Contract AT(45-1)-1830. 91p. Dep. NTIS.

A measurement of the infinite medium neutron multiplication factor was made for a tubular fuel containing an integral target rod in a light water lattice using the Physical Constants Test Reactor (PCTR). The concentration of boron in the moderator required to poison the cell to a k_∞ of unity was determined from a null reactivity measurement. The multiplication constant and neutron utilization ratios were inferred from measurements of the spatial distributions of neutron reaction rates, coupled with reactivity measurements. Considerable emphasis was placed on the various techniques used to make corrections to foil activation-data. In addition to the descriptions of the experiment and results, comparisons between experiment and theory are presented. 20 references. (auth)

1967 (N-70-24799) ESTIMATION OF SPATIAL CAPTURE DISTRIBUTIONS IN RESONANCE ABSORBERS. Bogart, Donald (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Apr 1970. 21p. (NASA-TN-D-5737; E-5186). NTIS.

A method is presented for computing spatial distributions of neutron capture in thick layers of resonance absorbers immersed in moderating media. It employs group effective resonance integrals to precalculate group effective resonance cross sections that are universal functions of distance into the absorptive layer. The method is illustrated for captures in ^{238}U for the energy region 0.5 eV to 100 keV. The method is applied to a spherical reactor-shield containing alternate layers of U and LiH; large differences in spatial capture and therefore in γ ray escape fractions are obtained compared to broad multigroup results. Application of the method to the epi-cadmium capture rates at various radii of U rods as measured by Hellstrand provided results that agreed with the experiments very well. (auth) (STAR)

Reactor Components, Fuels, and Accessories

Refer also to abstracts 315, 343, 366, 477, 628, 640, 641, 664, 665, 703, 721, 734, 737, 739, 756, 783, and 1848.

1968 (EURFNR-773) DIRECTLY ELECTRICALLY HEATED UO_2 FUEL ROD. Freund, D.; Schikarski, W. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik). Translation of report KFK-1031. 53p. Dep. NTIS.

Work Performed under United States-Euratom Fast Reactor Exchange Program.

The new method reported allows heating of sintered UO_2-rods by direct electric current without an internal axial metallic resistance heater. The temperature distribution of a direct electrically heated UO_2-rod is calculated by means of a digital computer program based upon radial power balance. The comparison between the direct electrically heated rod and the nuclear reactor fuel rod shows that a good simulation of the nuclear fuel temperature distribution can be achieved. Experimental and measuring devices are described. The stationary electrical heating of the UO_2-pin with electrical energy requires a power controlled circuit. The dynamic conditions are simulated by a pulsed current taken from a bank of capacitors. The method allows investiga-

tions on thermal and thermodynamic behavior of UO_2-fuel pins. Structural changes and physical effects due to temperature gradients can be simulated. Performance of UO_2-pins under dynamic conditions depending only on thermal influences are investigated. The method allows a partial simulation of pin failure and of nuclear reactor excursions with well defined parameters. Preliminary results with sintered UO_2-pins are reported. 15 references. (auth)

1969 IMPROVEMENTS IN OR RELATING TO PRESSURE CONTAINERS OF PRESTRESSED CONCRETE. (to Dyckerhoff and Widmann Kommanditgesellschaft). British Patent 1,210,793. 28 Oct 1970. Priority date 16 Jan 1968, Germany.

PRESSURE VESSELS—description of circular shaped prestressed concrete

REACTORS—pressure vessels for, description of circular shaped prestressed concrete (D.C.C.)

1970 DIGITAL DEVICE FOR THE MEASUREMENT AND CONTROL OF POWER AND PERIOD OF A NUCLEAR REACTOR. Kocandrle, L.; Lnenicka, B.; Drab, F. (to SKODA Works). Czechoslovak Patent 131,646. 10 Jan 1969. Filed 4 Jul 1967. (In Czech).

The application claims a digital device for the measurement and control of nuclear reactor power and period using the sequence analysis. The central block is formed by a differential scaler with a threshold preselection control. One input is connected to the output of a reference pulse-rate generator controlled by a controlling scaler connected to the input of said generator. The other input of the block is connected to the output of the object characterized by the pulse sequence to be measured or controlled. The attachment of a threshold controlling block to the output of the control scaler ensures the proportionality between the control scaler content and the preselected thresholds of the differential scaler. The threshold control output is connected to the differential scaler, the output of which is fed to the input of a differential block consisting of the two-directional scaler and time preselection circuit. (NSA of Czechoslovakia)

1971 FUTURE OF THE RECOVERY OF NUCLEAR FUELS IN EUROPE. Schueller, Walter (Gesellschaft zur Wiederaufbereitung von Kernbrennstoffen mbH, Leopoldshafen, Ger.). At. Strom; 16: 113-15(Aug 1970). (In German).

An investigation is made into the cost structure for the recovery of nuclear fuels, the market situation which arises from the present surplus capacity, and its effect on future development. In a series of recommendations, the attempt is made to influence positively the industrial expolitation of this important sector of the nuclear fuel cycle. (auth)

1972 ENERGY AVAILABILITY OF NUCLEAR FUELS. Pruschek, Rudolf (Univ., Stuttgart). Brennst.-Waerme-Kraft; 22: 429-34(Sep 1970). (In German).

The energy availability concept is applied to nuclear fuels and the energy of nuclear fission of ^{235}U is calculated. The significance of the absolute enthalpy and entropy for nuclear systems is discussed. Numerical calculation shows that the entropy term is negligible compared with the enthalpy differential. It follows that the nuclear energy released in the nuclear reaction is available for producing work. 13 references. (auth)

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GENERAL

1973 (AEC-tr-7027/5) NUKLEONIKA. Translation of Nukleonika; 14: 425-554(1969). 122p. (TT-69-50012/5). Dep. CFSTI.

1974 (AEC-tr-7027/6) NUKLEONIKA. Translation of Nukleonika; 14: 555-678(1969). 117p. (TT-69-50012/6). Dep. NTIS.

1975 (AEC-tr-7194) SPECIFIC COMPOSITION OF PHYTOPLANKTON IN A LAKE WARMED UP BY WASTE WATER FROM A THERMAL POWER STATION AND IN LAKES WITH NORMAL TEMPERATURES. Poltoracka, J. Translated from Acta Soc. Bot. Pol.; 37: 297-325(1968). 30p. Dep. NTIS.

1976 (ARLV-351-13) RADAR PRECIPITATION STUDY ESSA INTEROCEANIC CANAL PROJECT. Final Report. Schoner, Robert W. (Environmental Science Services Administration, Silver Spring, Md. Air Resources Labs.). July 1970. 115p. (ERLTM-ARL-23). Dep. NTIS.

1977 (BDX-613-148) CONTINUOUS FOAM BILLET FABRICATION. Aldrich, P. H. (Bendix Corp., Kansas City, Mo.). Aug 1970. Contract AT(29-1)-613. 12p. Dep. NTIS.

1978 (BNL-15158) STATISTICAL NOTIONS. Kumbaraci, Turkan E. (comp.) (Brookhaven National Lab., Upton, N. Y.). [nd]. 125p. Dep. NTIS.

1979 (BNL-15180) STATISTICAL APPLICATIONS SEMINARS, 1970-1971. Kumbaraci, T. (Brookhaven National Lab., Upton, N. Y.). [nd]. 35p. Dep. NTIS.

1980 (BNWL-1499) EXPERIMENTAL DRIFTS OF JUVENILE SALMONIDS THROUGH EFFLUENT DISCHARGES AT HANFORD. PART I. 1968 DRIFTS. Becker, C. D.; Coutant, C. C. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). 24 Sep 1970. Contract AT(45-1)-1830. 37p. Dep. NTIS.

1981 (BNWL-1508) THERMAL RESISTANCE OF ADULT COHO (ONCORHYNCHUS KISUTCH) AND JACK CHINOOK (O. TSHAWYTSCHA) SALMON, AND ADULT STEELHEAD TROUT (SALMO GAIRDNERI) FROM THE COLUMBIA RIVER. Coutant, Charles C. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Oct 1970. Contract AT(45-1)-1830. 26p. Dep. NTIS.

1982 (COO-773-21) LUMINESCENCE OF METAL COMPLEXES. Final Report, May 15, 1959-September 30, 1970. Forster, Leslie S. (Arizona Univ., Tucson. Dept. of Chemistry). Contract AT(11-1)-773. 13p. Dep. NTIS.

1983 (COO-1018-1216) SPECIFICATIONS FOR THE PREPARATION OF THE 1018-299-00 PRINTED CIRCUIT BOARD FOR THE WIRE WRAPPING. Krabbe, Paul (Illinois Univ., Urbana. Dept. of Computer Science). 18 Aug 1970. Contract AT(11-1)-1018. 3p. Dep. NTIS.

1984 (COO-1018-1217) SPECIFICATIONS FOR THE WIRE WRAP WIRING OF ILLIAC III SCANNER DRAWERS CONTAINING DIGITAL LOGIC. Krabbe, Paul (Illinois Univ., Urbana. Dept. of Computer Science). 18 Aug 1970. Contract AT(11-1)-1018. 4p. Dep. NTIS.

1985 (COO-1198-756) SECOND AND THIRD ORDER ELASTIC CONSTANTS OF MAGNESIUM. Naimon, Edwin Roland (Illinois Univ., Urbana). Sep 1970. Contract AT(11-1)-1198. 87p. Dep. NTIS.

1986 (COO-1198-760) VELOCITY OF SOUND IN SOLID KRYPTON. Kupperman, David Sander (Illinois Univ., Urbana). Oct 1970. Contract AT(11-1)-1198. 128p. Dep. NTIS.
Thesis.

1987 (COO-1198-762) X-RAY DEBYE TEMPERATURE OF SOLID KRYPTON. Windecker, Richard Chase (Illinois Univ., Urbana). Oct 1970. Contract AT(11-1)-1198. 146p. Dep. NTIS.
Thesis.

1988 (COO-1248-21) FUNDAMENTAL STUDY OF INERTIAL IMPACTORS. Marple, Virgil Alan (Minnesota Univ., Minneapolis. Particle Technology Lab.). Sep 1970. 261p. Dep. NTIS.
Thesis.

1989 (COO-1248-24) THE ELECTRICAL CHARGING OF SMALL PARTICLES AT LOW PRESSURES. Progress Report No. 8. Liu, Benjamin Y. H.; Whitby, Kenneth T. (Minnesota Univ., Minneapolis. Particle Technology Lab.). Oct 1970. Contract AT(11-1)-1248. 10p. Dep. NTIS.

1990 (COO-1289-21) SOME EFFECTS OF ALLOPURINOL ON IRON METABOLISM OF THE RAT. Awai, Michiyasu; Chipman, B.; Brown, Elmer B. (Washington Univ., St. Louis, Mo. School of Medicine). May 23, 1969. Contract AT(11-1)-1289. 12p. (CONF-680959-1). Dep. NTIS.
From 12th Congress of the International Society of Hematology, New York.

1991 (COO-1469-174) LOCAL INFORMATION RETRIEVAL FOR THE SIMULATION AND MODELING SYSTEM. Report No. 409. Levin, Harold (Illinois Univ., Urbana. Dept. of Computer Science). Aug 1970. Contract AT(11-1)-1469. 33p. Dep. NTIS.
Thesis.

1992 (COO-1700-16) INVESTIGATION OF THE ATOMIC STRUCTURE AND THE NATURE OF THE MAGNETISM IN SEVERAL MAGNETIC GLASSES. Final Progress Report. Hooper, H. O. (Wayne State Univ., Detroit, Mich. Dept. of Physics). Sep 1970. Contract AT(11-1)-1700. 27p. Dep. NTIS.

1993 (COO-1700-17) MAGNETIZATION AND ELECTRICAL CONDUCTIVITY STUDIES OF SOME TRANSITION METAL OXIDE GLASSES. Catchings III, Robert M. (Wayne State Univ., Detroit, Mich.). 1970. Contract AT(11-1)-1700. 138p. Dep. NTIS.
Thesis.

1994 (COO-1721-21) HIGH RESOLUTION SCANNING MICROSCOPY OF BIOLOGICAL SPECIMENS. Crewe, A. V. (Chicago Univ., Ill. Dept. of Physics. Chicago Univ., Ill. Enrico Fermi Inst.). [1970]. Contract AT(11-1)-1721. 27p. (CONF-700332-1). Dep. NTIS.
From Conference on Electron Microscopy, London, England.

1995 (COO-1750-1) [STUDY OF THE CONTROL OF THE LEVELS OF ENZYMES OF ARGININE BIOSYNTHESIS IN HIGHER PLANT CELLS]. Technical Progress Report, November 1, 1967-June 30, 1968. Dougall, D. K. (Ohio State Univ. Research Foundation, Columbus). July 30, 1968. Contract AT(11-1)-1750. 17p. Dep. NTIS.

1996 (COO-2011-3) A METHOD FOR THE DETERMINATION OF REGIONAL BLOOD FLOW IN TISSUES BY MEANS OF STIMULATED X-RAY FLUORESCENCE. Progress Report, January 1-December 31, 1970. (Washington Univ., St. Louis, Mo. Edward Mallinckrodt Inst. of Radiology). Contract AT(11-1)-2011. 25p. Dep. NTIS.

1997 (CTC-15(Rev.1)) SHOP SCHEDULING WITH KNOWN WORKLOADS. Hawthorne, J. E.; McLaren, R. A. (Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center). 30 Sep 1970. Contract W-7405-eng-26. 118p. Dep. NTIS.

1998 (IS-2205) ESTIMATION OF THE MEAN OF SKEWED DISTRIBUTIONS USING SYSTEMATIC STATISTICS. McElhone, Donald Hughes; Fuller, Wayne (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 131p. Dep. NTIS.
Thesis. Submitted by Donald Hughes McElhone.

1999 (IS-2410) METHOD FOR THE COMPLETE DEFINITION OF PROGRAMMING LANGUAGES. Wright, C. T.; Keller, R. F. (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 63p. Dep. NTIS.
Thesis. Submitted by Charles Thomas Wright, Jr.

2000 (IS-T-335) MOLECULAR ABSORPTION AND LIGHT SCATTERING IN FLAMES EMPLOYED FOR ATOMIC ABSORPTION SPECTROSCOPY. Fiorino, John Angelo (Ames Lab., Iowa). Aug 1970. Contract W-7405-eng-82. 179p. Dep. NTIS.
Thesis.

2001 (IS-T-378) HEAT CAPACITIES OF FOUR RARE EARTH TRICHLORIDE HEXAHYDRATES FROM 5 TO 300°K. Rulf, Donald Clarence (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 128p. Dep. NTIS.
Thesis.

2002 (IS-T-402) STUDY OF SOME HEXANUCLEAR MIXED-METAL CLUSTER COMPOUNDS CONTAINING TANTA-

LUM AND MOLYBDENUM. Meyer, John Louis (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 78p. Dep. NTIS. Thesis.

2003 (IS-T-407) SPECTROSCOPY OF MATRIX ISOLATED HIGH TEMPERATURE SPECIES. I. THALLOUS HALIDES. II. THALLOUS OXIDE. Brom, Joseph March Jr. (Ames Lab., Iowa). Oct 1970. Contract W-7405-eng-82. 114p. Dep. NTIS. Thesis.

2004 (KAPL-M-7131) CONCERNING THE RELATIONSHIP BETWEEN THE ELASTIC CONSTANTS AND PHENOMENOLOGICAL INTERATOMIC POTENTIALS. Brudnoy, David M. (Knolls Atomic Power Lab., Schenectady, N. Y.). Apr 1970. Contract W-31-109-eng-52. 19p. Dep. NTIS.

2005 (LA-4475) EMPIRICAL MODEL OF HETEROGENEOUS SHOCK INITIATION OF THE EXPLOSIVE 9404. Mader, Charles L. (Los Alamos Scientific Lab., N. Mex.). Jul 1970. Contract W-7405-eng-36. 13p. Dep. NTIS.

2006 (LA-4477) $0(h^{k-j}\,\omega(D^k f,h))$ BOUNDS ON SOME SPLINE INTERPOLATION ERRORS. Swartz, Blair K. (Los Alamos Scientific Lab., N. Mex.). May 1970. 73p. Dep. NTIS.

2007 (LA-4515) IMPROVED TECHNIQUE FOR USING THE FAST FOURIER TRANSFORM TO SOLVE CONVOLUTION-TYPE INTEGRAL EQUATIONS. Hunt, B. R. (Los Alamos Scientific Lab., N. Mex.). Sep 1970. Contract W-7405-eng-36. 22p. Dep. NTIS.

2008 (LF-tr-44) HEMATOLOGIC AND CYTOGENETIC STUDY OF CANINE LEUKEMIAS. Khrustalev, S. A.; Ponomar'kov, V. I. Translated for Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex., from Probl. Gematol. Pereliv. Krovi; 13: 40-5(1968). 11p. Dep. NTIS.

2009 (MLM-1765(TR)) DETERMINING THE SURFACE CONCENTRATION OF ION ADSORBATES WITH THE AID OF A TWO-ELECTRODE THIN-LAYER METHOD. Schmidt, E.; Siegenthaler, H. Translated for Mound Lab., Miamisburg, Ohio, from Helv. Chim. Acta; 52: 2245-55(1969). 19p. Dep. NTIS.

2010 (NYO-2038-7) STUDY OF THE FINE STRUCTURE, BIOCHEMISTRY, AND CONTROL OF BACTERIAL SPOROGENESIS. Annual Report, January 1, 1970-December 31, 1970. Lundgren, Donald G. (Syracuse Univ., N. Y. Dept. of Bacteriology and Botany). 14 Sep 1970. 32p. Dep. NTIS.

2011 (NYO-2391-117) ELECTRIC DIPOLE INTERACTIONS AMONG POLAR DEFECTS IN ALKALI HALIDES. Report No. 1410. Fiory, A. T. (Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics). Aug 1970. Contract AT(30-1)-2391. 47p. Dep. NTIS.

2012 (NYO-2504-69) PRESSURE AND TEMPERATURE DEPENDENCE OF THE ELASTIC CONSTANTS OF RbCl, RbBr, AND RbI. Report No. 1291. Ghafelehbashi, M. (Cornell Univ., Ithaca, N. Y. Materials Science Center). Jan 1970. Contract AT(30-1)-2504. 133p. Dep. NTIS. Thesis.

2013 (NYO-2504-77) CONTINUOUS WAVE ULTRASONIC INTERFEROMETER TO MEASURE SMALL CHANGES IN THE VELOCITY OF SOUND OF MATERIALS. Report No. 1389. Day, J. Paul; Ho, Paul S.; Ruoff, Arthur L. (Cornell Univ., Ithaca, N. Y. Materials Science Center). 25 Jun 1970. Contract AT(30-1)-2504. 46p. Dep. NTIS.

2014 (NYO-2504-78) PRESSURE AND TEMPERATURE DEPENDENCE OF THE ELASTIC CONSTANTS OF LiBr AND LiCl. Ching, L. S.; Ruoff, Arthur L. (Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering). [nd]. 29p. Dep. NTIS.

2015 (NYO-2798-54) ULTRAVIOLET IRRADIATION OF NUCLEIC ACIDS AND RELATED COMPOUNDS. Three Year Progress Report, September 1967-August 1970. Wang, Shih Y. (Johns Hopkins Univ., Baltimore, Md. Dept. of Biochemistry). Sep 1970. Contract AT(30-1)-2798. 8p. Dep. NTIS.

2016 (NYO-3326-29) COLLECTIVE AND PARTICLE MODES IN THE CLASSICAL LIQUID. Report No. 1387. Ortoleva, Peter Joseph Jr. (Cornell Univ., Ithaca, N. Y. Materials Science Center). Sep 1970. Contract AT(30-1)-3326. 116p. Dep. NTIS. Thesis.

2017 (NYO-3747-3) STRATOSPHERIC WINDS OVER AUSTRALIA. Interim Report, October 1, 1966-March 31, 1967. Laby, Jean E.; Unthank, E. L. (Melbourne Univ., Parkville (Australia). Dept. of Physics (RAAF Academy)). 79p. Dep. NTIS.

2018 (NYO-3747-5) STRATOSPHERIC WINDS OVER AUSTRALIA. Interim Report, April 1, 1967-September 30, 1967. Laby, Jean E.; Unthank, E. L. (Melbourne Univ., Parkville (Australia). Dept. of Physics (RAAF Academy)). 114p. Dep. NTIS.

2019 (NYO-3747-6) STRATOSPHERIC WINDS OVER AUSTRALIA. Interim Report, October 1, 1967-March 31, 1968. Laby, Jean E.; Unthank, E. L. (Melbourne Univ., Parkville (Australia). Dept. of Physics (RAAF Academy)). 125p. Dep. NTIS.

2020 (NYO-3747-10(Pt.1)) STRATOSPHERIC WINDS OVER AUSTRALIA. PART I. Interim Report, April 1, 1969-September 30, 1969. Laby, Jean E.; Unthank, E. L.; Barton, I. J. (Melbourne Univ., Parkville (Australia). Dept. of Physics (RAAF Academy)). 66p. Dep. NTIS.

2021 (NYO-3747-10(Pt.2)) STRATOSPHERIC WINDS OVER AUSTRALIA. PART II. Interim Report, April 1, 1969-September 30, 1969. Laby, Jean E.; Unthank, E. L.; Barton, I. J. (Melbourne Univ., Parkville (Australia). Dept. of Physics (RAAF Academy)). 150p. Dep. NTIS.

2022 (NYO-3983-19) NUCLEOCAPSID PROTEIN SUBUNITS OF SV5, NEWCASTLE DISEASE VIRUS AND SENDAI VIRUS. Mountcastle, Walter E.; Compans, Richard W.; Caliguiri, Lawrence A.; Choppin, Purnell W. (Rockefeller Univ., New York). [May 1970]. Contract AT(30-1)-3983. 25p. Dep. NTIS.

2023 (NYO-4073-2) CORRELATION OF DISLOCATION STRUCTURE WITH MICROSTRAIN DAMPING IN COPPER CRYSTALS. Dralla, John Raymond (State Univ. of New York, Stony Brook. Coll. of Engineering). Jan 1970. Contract AT(30-1)-4073. 48p. Dep. NTIS. Thesis.

2024 (NYO-4176-3) HIGH TEMPERATURE INORGANIC CHEMISTRY. First Annual Progress Report. Grosse, A. V.; Genter, R. B. (Germantown Labs., Inc., Philadelphia, Pa.). 28 Sep 1970. Contract AT(30-1)-4176. 39p. (GL-1970-12). Dep. NTIS.

2025 (ORNL-IBP-70-3) A PRELIMINARY BIBLIOGRAPHY OF MATHEMATICAL MODELING IN ECOLOGY. O'Neill, R. V.; Hett, J. M.; Sollins, N. F. (Oak Ridge National Lab., Tenn.). Oct 1970. Contract W-7405-eng-26. 97p. Dep. NTIS.

2026 (ORNL-TM-3155) SURVEY OF DESALTING PROCESSES FOR USE IN WASTE WATER TREATMENT. Spiewak, I. (Oak Ridge National Lab., Tenn.). 22 Sep 1970. 31p. Dep. CFSTI.

A review is given of processes used for waste water treatment, emphasizing new processes that appear to have potential for combination with desalting. A survey of developmental application of desalting processes to wastes is given. Cost estimates are given for a number of possible systems using desalting to treat effluent from a city of 1 million population. The analysis indicates that, although advanced waste treatments may increase the cost of sewage processing by factors of up to four times, the overall cost of water supply, sewerage and treatment need not be increased over about 30 per cent. It was concluded that desalting is primarily of value in systems that provide reusable product water. Such systems generate waste brines very difficult to dispose of, in many cases, except by distillation to dryness. (auth)

2027 (ORNL-TM-3186) INTEGER AND FLOATING-POINT STORAGE FOR FOCAL 69. The Molecular Anatomy (MAN) Program. Bell, P. R. (Oak Ridge National Lab., Tenn.). Nov 1970. Contract W-7405-eng-26. 6p. Dep. NTIS.

Floating-point numbers and integer numbers can be stored in another memory field in a small computer using a modification of FOCAL 69, permitting more extensive data handling capability. The modification is provided as an overlay to the standard FOCAL.

2028 (ORNL-tr-2378) STUDIES ON CARBON IN CYANAMIDE. Inoue, Yasuo; Sugino, Kiichiro; Shimizu, Mitsuaki. Translated for Oak Ridge National Lab., Tenn., from Kogyo Kagaku Zasshi; 61: 1565-70(1958). 17p. Dep. NTIS.

2029 (ORO-1637-16) THE ORIGIN AND FATE OF THIOCYANATE ION IN METABOLISM. Progress Report, May 1, 1968-April 30, 1969. Wood, John L. (Tennessee Univ., Memphis). May 1, 1969. Contract AT(40-1)-1637. 34p. Dep. NTIS.

XUM

2030 (ORO-3603-6) A. THE HYDROGEN FLUORIDE SOLVENT SYSTEM. B. MOESSBAUER STUDIES ON RARE EARTH COMPOUNDS. Annual Report No. 4. Clifford, A. F. (Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry). Aug 1970. Contract AT(40-1)-3603. 7p. Dep. NTIS.

2031 (ORO-3603-7) MOESSBAUER EFFECT STUDIES ON ^{151}Eu IN MIXED OXIDE STRUCTURES. Dulaney, G. W.; Clifford, A. F. (Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry). [1970]. Contract AT(40-1)-3603. 20p. Dep. NTIS.

2032 (ORO-3736-4) A SPECTROSCOPIC AND PHOTOCHEMICAL STUDY OF VISION PIGMENTS AND OTHER ORGANIC MOLECULES. Annual Progress Report, October 15, 1968-July 1, 1969. Becker, Ralph S. (Houston Univ., Tex. Dept. of Chemistry). July 10, 1969. Contract AT(40-1)-3736. 38p. Dep. NTIS.

2033 (ORO-4025-1) STUDIES ON THE ROLE OF NERVE IN AMPHIBIAN LIMB REGENERATION. Progress Report. Dresden, Marc H. (Baylor Univ., Houston, Tex. Coll. of Medicine). 28 Oct 1970. 6p. Dep. NTIS.

2034 (RFP-1540) EXTENDED BASIC COMPUTER PROGRAM FOR PHOTOGRAPHIC EMULSION CALIBRATION IN EMISSION SPECTROSCOPY. Barton, Harlan N. (Dow Chemical Co., Golden, Colo. Rocky Flats Div.). 9 Oct 1970. Contract AT(29-1)-1106. 12p. Dep. NTIS.

2035 (RLO-2095-2) EARTH TILTS IN CONNECTION WITH CRUSTAL FAILURE, A STUDY IN ALASKA. Berg, Ed. (Alaska Univ., College. Geophysical Inst.). Oct 1970. Contract AT(45-1)-2095. 31p. Dep. NTIS.

2036 (RLO-2227-T-3-1) MUTANT STUDIES ON THE PHOTOSYSTEM II PORTION OF THE PHOTOSYNTHETIC PROCESS. Yearly Progress Report, September 1, 1969-September 1, 1970. Bishop, Norman I. (Oregon State Univ., Corvallis. Dept. of Botany). 12 Oct 1970. Contract AT(45-1)-2227. 17p. Dep. NTIS.

2037 (SC-DR-70-218) METHOD FOR COMPUTING THE COLLAPSE LOADS OF HEATED, ARBITRARILY LOADED SPHERICAL SHELLS IN AN ELASTIC MEDIUM. Murfin, Walter B. (Sandia Labs., Albuquerque, N. Mex.). Oct 1970. 52p. Dep. NTIS.

2038 (SC-RR-70-454) LIQUID-PROPELLANT ROCKET ABORT FIRE MODEL. Bader, B. E.; Donaldson, A. B.; Hardee, H. C. (Sandia Labs., Albuquerque, N. Mex.). Oct 1970. 35p. Dep. NTIS.

2039 (SC-RR-70-547) FAILURE PROBABILITIES FOR LOG-NORMAL CAPACITY DISTRIBUTION WITH NORMAL DISTRIBUTION OF DEMANDS. Reed, Jack W. (Sandia Labs., Albuquerque, N. Mex.). Oct 1970. 12p. Dep. NTIS.

2040 (SC-T-70-4038) FINITE DIFFERENCE EQUATIONS FOR CALCULATING THREE-DIMENSIONAL BOUNDARY LAYERS. Krause, Egon; Hirschel, Ernst Heinrich; Bothmann, Thorolf. Translated by Marcel I. Weinreich (Sandia Labs., Albuquerque, N. Mex.), from report DLR-FB-69-66. 113p. Dep. NTIS.

2041 (SU-326-P-29-5) APPLICATION OF CONTROLLED ELECTROMAGNETIC FORCES DURING SOLIDIFICATION OF TYPE 304 STAINLESS STEEL. Quarterly Progress Report No. 5, June 1-September 30, 1970. Sherby, O. D.; Tiller, W. A. (Stanford Univ., Calif. Dept. of Materials Science). Contract AT(04-3)-326. 4p. Dep. NTIS.

2042 (SU-1206-227) CONTINUOUS REPRESENTATIONS AND THE KERNEL FUNCTION. Gomatam, Jagannathan; Gardiner, C. W. (Syracuse Univ., N. Y. Dept. of Physics). Jul 1970. 18p. (NYO-3399-227). Dep. NTIS.

2043 (TID-3760) BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. Issued or in Progress During the Period July-September 1970. (Division of Technical Information Extension (AEC), Oak Ridge, Tenn.). 11p. DTIE Free.

2044 (TID-25460) ENDOCRINE AND METABOLIC STUDIES UTILIZING RADIOISOTOPES AND LABELED HORMONES. Final Report. Talmage, Roy V. (Rice Univ., Houston, Tex.). [1970]. Contract AT(40-1)-284. 24p. Dep. CFSTI.

2045 (TID-25560) AN ENERGY CIRCUIT LANGUAGE FOR ECOLOGICAL AND SOCIAL SYSTEMS: ITS PHYSICAL BASIS. Progress Report, Appendix 1. Odum, Howard T. (North Carolina Univ., Chapel Hill). Nov 1969. Contract AT-(40-1)-3666. 94p. Dep. NTIS.

2046 (TID-25561) SYSTEMS OF MAN AND NATURE. Annual Report. Odum, Howard T. (North Carolina Univ., Chapel Hill). 1 May 1970. Contract AT(40-1)-3666. 162p. Dep. NTIS.

2047 (TID-25568) ACTIVITIES OF NUCLEIC ACIDS AS A GENETIC PROBE. Final Progress Report. Spizizen, John (Scripps Clinic and Research Foundation, La Jolla, Calif. Dept. of Microbiology). 22 Sep 1970. Contract AT(04-3)-632. 26p. Dep. NTIS.

2048 (UCLA-10-P-14-92) SEMIANNUAL PROGRESS REPORT. Estrin, Gerald (California Univ., Los Angeles. Dept. of Computer Science). Apr 1970. Contract AT(11-1)-Gen-10. 16p. Dep. NTIS.

2049 (UCRL-19608) PRECIPITATION IN HIGH PURITY SILICON SINGLE CRYSTALS. Nes, Aasmund Erik (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 96p. Dep. NTIS.
Thesis.

2050 (UCRL-19625) GLIDE AND CLIMB OF PRISMATIC DISLOCATION HALF-LOOPS IN HIGHLY PERFECT COPPER CRYSTALS. Miura, Yasuhiro (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 82p. Dep. NTIS.
Thesis.

2051 (UCRL-19639) PROTON EXCHANGE RATES AND NUCLEAR MAGNETIC RESONANCE RELAXATION IN AQUEOUS SOLUTIONS OF A HYDROLYTIC TRIMER OF Cr(III) ION. Lee, Ronald Tse (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 82p. Dep. NTIS.
Thesis.

2052 (UCRL-19662) OPTICAL SPECTROSCOPIC STUDIES OF METAL ATOMS AND MOLECULES IN THE LOW TEMPERATURE MATRICES. Chang, Chin-An (California Univ., Berkeley. Lawrence Radiation Lab.). Aug 1970. Contract W-7405-eng-48. 159p. Dep. NTIS.
Thesis.

2053 (UCRL-50904) OPTICAL REFLECTANCE AND ELECTRONIC STRUCTURE OF DILUTE ALLOYS: ALUMINUM IN SILVER AND GOLD. Irani, G. B. (California Univ., Livermore. Lawrence Radiation Lab.). 13 Jul 1970. 89p. Dep. NTIS.
Thesis.

2054 (UCRL-Trans-1410) STUDY OF TAUTOMERISM OF N-BUTYL-4(2)-CARBOMETHOXYPYRROLIDONES-3 AND THEIR HYDROCHLORIDES. Arbuzov, B. A.; Erastov, O. A.; Remizov, A. B.; Nikonova, L. Z. Translated for Univ. of California, Lawrence Radiation Lab., Berkeley, from Khim. Geterotsikl. Soedin., Akad. Nauk Latv. SSR; No. 6, 978-85(1969). 12p. Dep. NTIS.

2055 (UCRL-Trans-1412) INVESTIGATION OF THE STRUCTURE OF METAL LAYERS BY ELECTRON-MICROSCOPE AND ELECTRON-DIFFRACTION METHODS. Palatnik, L. S.; Kossevich, V. M.; Antonova, V. A. Translated by L. B. Kapp for Univ. of California Lawrence Radiation Lab., Berkeley, from pp 104-9 of International Symposium on Basic Problems in Thin-Film Physics, Clausthal-Gottingen, Germany, September 6-11, 1965. 23p. (CONF-650936-3). Dep. NTIS.

2056 (UCRL-Trans-10480) OPTICAL PROPERTIES OF AMORPHOUS InSb, GaSb, AND GaAs. Niklas, J.; Stuke, J.; Zimmerer, G. Translated by L. B. Kapp for Univ. of California, Lawrence Radiation Lab., Livermore, from Spring Meeting of the German Physical Society, Freudenstadt, Germany, April 6-11, 1970. 9p. (CONF-700423-1). Dep. CFSTI.

2057 (USGS-474-86) THICKNESS OF SURFICIAL DEPOSITS AND TUFF IN YUCCA FLAT, NEVADA TEST SITE. Fernald, Arthur T. (Geological Survey, Denver, Colo.). 1970. Contract AT(29-2)-474. 9p. (NTS-224). Dep. NTIS.

2058 (USGS-474-98) U. S. GEOLOGICAL SURVEY TRACER STUDY, AMARGOSA DESERT, NYE COUNTY, NEVADA. PART I. EXPLORATORY DRILLING, TRACER WELL CONSTRUCTION AND TESTING, AND PRELIMINARY FINDINGS. Johnston, Richard H. (Geological Survey, Washington, D. C.). 1968. 64p. Dep. NTIS.

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Murine and human leukemia, 25:584 (CONF-680529-, pp 186-218)
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Prog. rpt. on luminescence of metal complexes, final, 5/15/59--9/30/70, 25:1982 (COO-773-21)
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Atlantic Richfield Company Reprocessing Center. Safety analysis report, Vol. 2, 25:210 (DOCKET-50372-2)
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Comparison of sublimation and vaporization for purification of samarium metal, 25:203 (CONF-700403-(Vol.2), pp 532-44)
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CALIFORNIA UNIV., IRVINE. DEPT. OF PHYSICS.
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Prog. rpt. on computer science, semiannual, 11/69--4/70, 25:2048 (UCLA-10-P-14-92)
CALIFORNIA UNIV., LOS ANGELES. LAB. OF NUCLEAR MEDICINE AND RADIATION BIOLOGY.
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CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE, MOL (BELGIUM).
Prog. rpt. of Operations Group of BR-2 reactor, annual, 1968, 25:1921 (EUR-4416)
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, BELLEVUE (FRANCE). LABORATOIRE DES TERRES RARES.
Electron-diffraction studies on thin films of Sm_2O_3, 25:765 (CONF-700403-(Vol.1), pp 140-51)
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CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, GRENOBLE (FRANCE). LABORATOIRE D'ELECTROSTATIQUE ET PHYSIQUE DU METAL.
Resistivity and magnetic susceptibility of compounds in Sn--Sm system, 25:1316 (CONF-700403-(Vol.1), pp 322-32)
CHICAGO UNIV., ILL. DEPT. OF PHYSICS.
General local interactions and tests of V-A theory in neutrino scattering processes, 25:1467 (COO-264-559)
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CHICAGO UNIV., ILL. ENRICO FERMI INST.
General local interactions and tests of V-A theory in neutrino scattering processes, 25:1467 (COO-264-559)
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Wm. H. Zimmer Nuclear Power Station, Units 1 and 2. Preliminary safety analysis report, Amendment 1, 25:1839 (DOCKET-50358-7)
COLUMBIA UNIV., NEW YORK. PEGRAM NUCLEAR PHYSICS LABS.
Progress report [on nuclear physics], January 1969--December 1969, 25:1739 (NYO-73-293)
COLUMBUS AND SOUTHERN OHIO ELECTRIC CO., COLUMBUS, OHIO.
Wm. H. Zimmer Nuclear Power Station, Units 1 and 2. Preliminary safety analysis report, Amendment 1, 25:1839 (DOCKET-50358-7)
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COMMISSARIAT A L'ENERGIE ATOMIQUE, SACLAY (FRANCE). CENTRE D'ETUDES NUCLEAIRES.
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La Salle County Station, Units 1 and 2. Preliminary safety analysis report, Vol. 2, 25:1842 (DOCKET-50373-3)
Quad-Cities Station, Unit 1. Reactor pressure vessel fire, September 27, 1970, 25:1786 (DOCKET-50254-21)

CONNECTICUT YANKEE ATOMIC POWER CO., HARTFORD.
Connecticut Yankee Atomic Power Plant. Preliminary safety analysis report, Amendment 20, 25:1821 (DOCKET-50213-79)

CONNECTICUT YANKEE ATOMIC POWER CO., WESTBORO, MASS.
Connecticut Yankee Atomic Power Plant. Effect of oil and extinguisher material on reactor-coolant piping and pump at Connecticut-Yankee. Technical report E-1344, 25:1822 (DOCKET-50213-80)
Connecticut Yankee Atomic Power Plant. Malfunction of pressurizer level instrumentation, 25:1796 (DOCKET-50213-81)

CONSOLIDATED EDISON CO. OF NEW YORK, INC., NEW YORK.
Indian Point Station, Unit No. 1. Examination of the 24-inch line, 25:1780 (DOCKET-50003-58)
Indian Point Station, Unit No. 1. Report on leakage rate test of containment structure (Errata), 25:1812 (DOCKET-50003-57)

CONSUMERS POWER CO., JACKSON, MICH.
Big Rock Point Nuclear Plant. Comments on uniform monitoring, recording, and reporting of radionuclide releases from nuclear power facilities, 25:1819 (DOCKET-50155-52)
Big Rock Point Nuclear Plant. Design modification necessary for installation of control rod drive support structure, 25:1818 (DOCKET-50155-51)

CORNELL-SYDNEY UNIV. ASTRONOMY CENTRE, SYDNEY (AUSTRALIA).
Model for the radiations from the compact strong sources, 25:854 (N-70-35168)

CORNELL UNIV., ITHACA, N.Y. DEPT. OF APPLIED PHYSICS.
Fluctuations near phase transition in one-dimensional superconductors, 25:1094 (NYO-3029-45)

CORNELL UNIV., ITHACA, N. Y. DEPT. OF MATERIALS SCIENCE AND ENGINEERING.
Pressure and temperature dependence of elastic constants of LiBr and LiCl, 25:2014 (NYO-2504-78)

CORNELL UNIV., ITHACA, N. Y. LAB. OF ATOMIC AND SOLID STATE PHYSICS.
Electric dipole interactions among polar defects in alkali halides, 25:2011 (NYO-2391-117)

CORNELL UNIV., ITHACA, N. Y. MATERIALS SCIENCE CENTER.
Collective and particle modes in classical liquid, 25:2016 (NYO-3326-29)
Continuous wave ultrasonic interferometer to measure small changes in velocity of sound of materials, 25:2013 (NYO-2504-77)
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DARTMOUTH COLL., HANOVER, N. H. THAYER SCHOOL OF ENGINEERING.
Implementation of advanced technology for cast metals, 25:761 (AD-706221)

DAYTON POWER AND LIGHT CO., OHIO.
Wm. H. Zimmer Nuclear Power Station, Units 1 and 2. Preliminary safety analysis report, Amendment 1, 25:1839 (DOCKET-50358-7)

DAYTON UNIV., OHIO. DEPT. OF ELECTRICAL ENGINEERING.
Magnetic aftereffect and aging of $Sm(Co,Cu,Fe)_5$ alloys, 25:1309 (CONF-700403-(Vol.1), pp 21-33)
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DAYTON UNIV., OHIO. RESEARCH INST.
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DIVISION OF RADIATION PROTECTION STANDARDS (AEC), WASHINGTON, D.C.
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DIVISION OF REACTOR LICENSING (AEC), WASHINGTON, D. C.
Dresden Nuclear Power Station, Unit 2. License No. DPR-19; technical specifications Change No. 6, 25:1826 (DOCKET-50237-83)
H. B. Robinson Unit No. 2. Facility License No. DPR-23, Amendment 1, 25:1831 (DOCKET-50261-44)
Millstone Nuclear Power Station, Unit 1. Authority to operate at 2011 Mw thermal, 25:1828 (DOCKET-50245-41)
N. S. Savannah. Facility License No. NS-1, Amendment 7. Transfer authority to operate the nuclear reactor from FAST to MARAD, 25:1948 (DOCKET-50238-73)
Yankee Nuclear Power Station. License No. DPR-3; technical specifications Change No. 91, 25:1781 (DOCKET-50029-138)

DIVISION OF TECHNICAL INFORMATION EXTENSION (AEC), OAK RIDGE, TENN.
Bibliographies of atomic energy literature, 7--9/70, 25:2043 (TID-3760)
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DOUGLAS UNITED NUCLEAR, INC., RICHLAND, WASH.
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DOW CHEMICAL CO., GOLDEN, COLO. ROCKY FLATS DIV.
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DU PONT DE NEMOURS (E.I.) AND CO., AIKEN, S. C. SAVANNAH RIVER LAB.
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DUKE POWER CO., CHARLOTTE, N.C.
Oconee Nuclear Station, Units 1, 2, and 3. Preliminary safety analysis report, Amendment 22, 25:1803 (DOCKET-50269-27)

DUKE UNIV., DURHAM, N.C. DEPT. OF PHYSICS.
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EUROPEAN ATOMIC ENERGY COMMUNITY.
Ambipolar potential effects on Coulomb scattering into the loss cone, 25:1198 (CEA-CONF-1609)
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Consequences of the rupture of a pressure tube or of a complete channel in an ORGEL-type reactor, 25:1907 (EUR-4493)
EUROPEAN COMPANY FOR THE CHEMICAL PROCESSING OF IRRADIATED FUELS, MOL (BELGIUM).
Distribution of nitric acid between water and 100 percent tri-n-butyl phosphate at various temperatures, 25:219 (NP-18399)
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Veneziano formula, 25:1484 (CONF-691202-, Paper 3)

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FLORIDA POWER AND LIGHT CO.
Turkey Point Plant, Units No. 3 and No. 4. Additional information requested on FSAR. Preliminary safety analysis report, Amendment 25, Suppl. 25, 25:1829 (DOCKET-50250-32)
Turkey Point Plant, Units No. 3 and No. 4. Additional information requested on FSAR. Preliminary safety analysis report, Amendment 26, Suppl. 26, 25:1785 (DOCKET-50250-33)
Turkey Point Plant, Units No. 3 and No. 4. Preliminary safety analysis report, Amendment 28, Suppl. 28, 25:1830 (DOCKET-50250-34)
FORSKNINGRADENS LABORATORIUM, STUDSVIK (SWEDEN).
Electron spin resonance studies on irradiated heterogeneous systems. VI, 25:129 (NP-18478)
FORSVARETS FORSKNINGSANSTALT, STOCKHOLM (SWEDEN).
Experimental techniques for tracer element analysis, 25:6 (FOA-4-4432)
FREIBURG UNIV. (WEST GERMANY). CHEMISCHES LABORATORIUM.
Mixed crystal phases in ThO_2--PrO/sub x/, 25:764 (CONF-700403-(Vol.1), pp 115-26)

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GENERAL ELECTRIC CO., SAN JOSE, CALIF. ATOMIC POWER EQUIPMENT DEPT.
Analysis of functional common-mode failures in BWR protection and control instrumentation, 25:1899 (NEDO-10189)
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GENERAL MOTORS CORP., SANTA BARBARA, CALIF. AC ELECTRONICS--DEFENSE RESEARCH LABS.
Cross sections for ionization in collisions between excited nitrogen molecules and carbon monoxide and nitrogen ground-state molecules, 25:983 (N-70-32469)
GEOLOGICAL SURVEY, DENVER, COLO.
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U. S. Geological survey tracer study, Amargosa Desert, Nye County, Nevada. I, 25:2058 (USGS-474-98)
GEORGIA UNIV., ATHENS. DEPT. OF PHYSICS.
Cosmic ray search for fast magnetic charges, 25:1022 (N-70-35591)
GERMANTOWN LABS., INC., PHILADELPHIA, PA.
Prog. rpt. on high temperature inorganic chemistry, annual, 9/70, 25:2024 (NYO-4176-3)
GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOI ENERGII SSSR, MOSCOW. INSTITUT TEORETICHESKOI I EKSPERIMENTAL'NOI FIZIKI.
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GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOI ENERGII SSSR, OBNINSK. FIZIKO-ENERGETICHESKII INSTITUT.
Questions concerning the detection of the entry of water into sodium, 25:1878 (ANL-Trans-857)
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GULF GENERAL ATOMIC, INC., SAN DIEGO, CALIF.
Prog. rpt. on radiation effects in silicon solar cells, 4--6/70, 25:481 (N-70-33998)
Research on graphite. Quarterly progress report for the period ending August 14, 1970, 25:780 (GA-10268)
GULF RADIATION TECHNOLOGY, SAN DIEGO, CALIF.
Application of photoinduced reactions to nuclear materials safeguards problems. Project summary report, July 1, 1969--June 30, 1970, 25:355 (GA-10272)

H

HAHN-MEITNER-INSTITUT FUER KERNFORSCHUNG, BERLIN (WEST GERMANY).
Chemical aspects of reactor safety. IV, 25:1908 (HMI-B-99)
HAWAII UNIV., HONOLULU.
Comments on the compatibility of the veneziano model with current algebra and chiral symmetry, 25:1498 (UH-511-79-70)
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HAWAII UNIV., HONOLULU. DEPT. OF PHYSICS AND ASTRONOMY.
Prog. rpt. on high energy physics, annual, 10/15/70, 25:1356 (UH-511-87-70)
HOUSTON UNIV., TEX. DEPT. OF CHEMISTRY.
Prog. rpt. on a spectroscopic and photochemical study of vision pigments, annual, 10/15/68--7/1/69, 25:2032 (ORO-3736-4)

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IDAHO NUCLEAR CORP., IDAHO FALLS.
Experimental investigations of reactor system blowdown, 25:1909 (IN-1348)
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(IN-1390)
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Air Resources Laboratories Field Research Office, Environmental Science Servcies Administration, 25:277 (IDO-12073, pp 46-9)
Analytical Chemistry Branch, 25:40 (IDO-12073, pp 28-36)
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ILLINOIS UNIV., URBANA. COORDINATED SCIENCE LAB.
Mixed-boundary initial-value problem for Vlasov equation, 25:1196 (AD-707676)
ILLINOIS UNIV., URBANA. DEPT. OF COMPUTER SCIENCE.
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ILLINOIS UNIV., URBANA. DEPT. OF PHYSICS.
Study of 3π final state interactions in the reaction π⁻p → p π⁺π⁻π⁻ at 5 and 7.5 GeV/c, 25:1408 (COO-1195-197)
IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF PHYSICS.
Research on elementary particles, 25:1429 (AD-706920)
INDIAN INST. OF TECH., KANPUR. DEPT. OF CHEMISTRY.
Semiconduction in rare earth oxides, 25:1317 (CONF-700403-(Vol.1), pp 345-54)
INNSBRUCK UNIV. (AUSTRIA). INSTITUT FUER THEORETISCHE PHYSIK.
Physics of quiescent plasmas, 25:1188 (AD-709230)
INSTITUT C.N.R.S. DE RECHERCHE SUR LA CATALYSE, VILLEURBANNE (FRANCE).
Oxidation of pure or alloyed zirconium by oxygen and steam, 25:618 (EUR-4507)
INSTITUT FUER PLASMAPHYSIK, G.M.B.H. GARCHING (WEST GERMANY).
Properties of marginally-stable collisionless drift-universal modes with application to the W-II stellarator, 25:1242 (IPP-6/85)
INSTITUTE FOR ADVANCED STUDY, PRINCETON, N. J.
General local interactions and tests of V-A theory in neutrino scattering processes, 25:1467 (COO-264-559)
INSTITUTE OF NUCLEAR RESEARCH, WARSAW (POLAND).
Polish--Italian Seminar on Some Chemical, Ceramic, and Metallurgical Aspects of Nuclear Fuels, 25:631 (INR-1194)
Prog. rpt. on nuclear data research in Poland, annual, 5/69--4/70, 25:1736 (INR-1197)
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INSTITUTE OF NUCLEAR SCIENCES, LOWER HUTT (NEW ZEALAND).
Prog. rpt. on nuclear sciences, semiannual, 1--6/69, 25:460 (NP-18408)
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).
Conference on use of isotopes in hydrology, Vienna, 3/70, 25:262 (STI/PUB-255)
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Effect of sixth-period elements on melting and transformation temperatures of Pr, 25:685 (CONF-700403-(Vol.2), pp 570-81)
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ISTITUTO NAZIONALE DI FISICA NUCLEARE, ROME (ITALY).
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J

JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
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JERSEY CENTRAL POWER AND LIGHT CO., MORRISTOWN, N. J.
Oyster Creek Nuclear Power Plant, Unit No. 1. Abnormal occurrence report: failure of the Torus Oxygen Sample Line Isolation Valve, 25:1797 (DOCKET-50219-114)
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JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF BIOCHEMISTRY.
Prog. rpt. on ultraviolet irradiation of nucleic acids and related compounds, 9/67--8/70, 25:2015 (NYO-2798-54)
JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF RADIOLOGICAL SCIENCES.
Interaction and linkage of polycyclic hydrocarbons to nucleic acids, 25:142 (TID-25513)
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KERNFORSCHUNGSZENTRUM, KARLSRUHE (WEST GERMANY). INSTITUT FUER ANGEWANDTE REAKTORPHYSIK.
Arrangement and function of on-line system for data acquisition and experiment control for SNEAK, 25:1923 (KFK-1188)
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Specifications of the CAMAC 25-MHz counter module Type LEM-52/1.1, 25:459 (KFK-1184)
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Prog. rpt. on Gundremmingen nuclear power plant, 8/70, 25:1804 (TID-25558)
KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Concerning the relationship between the elastic constants and phenomenological interatomic potentials, 25:2004 (KAPL-M-7131)
KYOTO UNIV. (JAPAN). RESEARCH REACTOR INST.
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L

LEYBOLD-HERAEUS G.M.B.H., COLOGNE (WEST GERMANY).
Method of concentrating and drying liquid radioactive waste, 25:213 (EUR-4047(Pt.2))
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0 (h/sup k-jγω(D/sup k/f,h)) bounds on some spline interpolation errors, 25:2006 (LA-4477)
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MCDONNELL DOUGLAS ASTRONAUTICS CO., RICHLAND, WASH. DONALD W. DOUGLAS LABS.
Thulium oxide microsphere preparation and characterization, 25:722 (CONF-700403-(Vol.1), pp 193-200)
MAGYAR TUDOMANYOS AKADEMIA KOZPONTI FIZIKAI KUTATO INTEZETE, BUDAPEST.
SISYPHUS: code for solution of few-group diffusion equations in two dimensions, 25:1955 (KFKI-70-13-RPT)
MARYLAND UNIV., COLLEGE PARK.
Investigation of irradiation strengthening of bcc metals and solid solutions. Progress report, January 1970--October 1970, 25:706 (ORO-3612-7)
Solid solution weakening of bcc solid solutions, 25:651 (CONF-700819-4)
MASSACHUSETTS INST. OF TECH., CAMBRIDGE. CENTER FOR SPACE RESEARCH.
Cosmic x-ray spectrometer, 25:414 (N-70-28461)
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MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF MECHANICAL ENGINEERING.
Theoretical prediction of acoustic-gravity pressure waveforms generated by large explosions in the atmosphere, 25:293 (AD-707122)
MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF NUCLEAR ENGINEERING.
Properties of marginally-stable collisionless drift-universal modes with application to the W-II stellarator, 25:1242 (IPP-6/85)
MATHEMATICAL APPLICATIONS GROUP, INC., WHITE PLAINS, N.Y.
TERF Monte Carlo fallout code calculations, 25:353 (AD-706853)
MEDICAL RESEARCH COUNCIL, OXFORD (ENGLAND). BONE-SEEKING ISOTOPES UNIT.
Radiation and myeloproliferative disorders in man, 25:596 (CONF-680529-, pp 489-500)
MELBOURNE UNIV., PARKVILLE (AUSTRALIA). DEPT. OF PHYSICS (RAAF ACADEMY).
Stratospheric winds over Australia, 25:2020 (NYO-3747-10(Pt.1))
Stratospheric winds over Australia, 25:2021 (NYO-3747-10(Pt.2))
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MIAMI UNIV., CORAL GABLES, FLA. DEPT. OF PHYSICS.
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MICHIGAN UNIV., ANN ARBOR.
Phenomenological analyses using poles and cuts, 25:1483 (CONF-691202-, Paper 2)
MINNESOTA UNIV., MINNEAPOLIS. PARTICLE TECHNOLOGY LAB.
Fundamental study of inertial impactors, 25:1988 (COO-1248-21)
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MISSISSIPPI UNIV., UNIVERSITY. DEPT. OF CHEMISTRY.
Prog. rpt. on investigation of gamma-ray induced polymer formation of the carboranes, 11/70, 25:141 (ORO-3781-7)
MISSOURI UNIV., ROLLA.
Magnetic structure of $HoFe_2$, 25:1310 (CONF-700403-(Vol.1), pp 34-40)
MONTANA UNIV., MISSOULA.
Strontium-90-induced leukemogenesis in swine, 25:588 (CONF-680529-, pp 703-20)
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Effect of hydrolysis on the disproportionation of tetravalent and pentavalent plutonium ions, 25:72 (MLM-1743)
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, CLEVELAND, OHIO. LEWIS RESEARCH CENTER.
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UNAMIT: one-dimensional 4 π spherical multilayer reactor-shield-weight optimization code, 25:1875 (N-70-32598)
NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
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NEBRASKA UNIV., LINCOLN. DEPT. OF CHEMISTRY.
Reactions of iodine activated by the neutron capture process in liquid and solid alkanes and alkenes, 25:187 (COO-1617-24)
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NEW MEXICO UNIV., ALBUQUERQUE.
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NEW YORK OPERATIONS OFFICE (AEC), N. Y. HEALTH AND SAFETY LAB.
Dosimetry study of thermally stimulated exoelectron emission (TSEE) with lithium fluoride, 25:437 (HASL-236)

NEW YORK STATE ATOMIC AND SPACE DEVELOPMENT AUTHORITY, NEW YORK.
Thermal profile of waters of New York state, 25:1845 (NP-18494)

NIAGARA MOHAWK POWER CORP., SYRACUSE, N. Y.
Nine Mile Point Nuclear Station. Petition requesting amendment of license, Amendment 2. Technical supplement to petition to increase power level, Second Addendum, 25:1823 (DOCKET-50220-50)
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NORTH CAROLINA STATE UNIV., RALEIGH.
Computer experiment studies on mechanisms for irradiation induced defect production and annealing processes. Progress report for period ending 2/28/70, 25:707 (CRO-3912-3)

NORTH CAROLINA UNIV., CHAPEL HILL.
Prog. rpt. on energy circuit language for ecological and social systems, 11/69, 25:2045 (TID-25560)
Prog. rpt. on systems of man and nature, annual, 5/70, 25:2046 (TID-25561)

NOTRE DAME UNIV., IND.
Prog. rpt. on the interaction of photons and particles with nuclei, annual, 11/69--10/70, 25:1763 (COO-427-105)

NUCLEAR-CHICAGO CORP., AUSTIN, TEX. TEXAS NUCLEAR DIV.
External beam measurements on the Texas A and M variable energy cyclotron, 25:520 (AD-708428)

NUCLEAR FUEL SERVICES, INC., WEST VALLEY, N.Y.
West Valley Reprocessing Plant. Environmental report No. 7, July--December 1969, 25:258 (DOCKET-50201-48)
West Valley Reprocessing Plant. Environmental report No. 8, January--June 1970, 25:259 (DOCKET-50201-49)
West Valley Reprocessing Plant. Quarterly report, July 1--September 30, 1970, 25:208 (DOCKET-50201-50)

NUCLEAR MATERIALS AND EQUIPMENT CORP., APOLLO, PA.
Prog. rpt. on plant instrumentation program, 4--6/70, 25:38 (BHO-69-1)

NUS CORP., ROCKVILLE, MD.
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O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
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Bibliography of mathematical modeling in ecology, 25:2025 (ORNL-IBP-70-3)
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OESTERREICHISCHE STUDIENGESELLSCHAFT FUER ATOMENERGIE G.M.B.H., SEIBERSDORF.
Determination of fission product activities in graphite, 25:39 (DP-Report-324)

OHIO STATE UNIV. RESEARCH FOUNDATION, COLUMBUS.
Prog. rpt. on control of levels of enzymes of Arginine biosynthesis in higher plant cells, 11/1/67--6/30/68, 25:1995 (COO-1750-1)

OMAHA PUBLIC POWER DISTRICT, NEBR.
Fort Calhoun Station, Unit No. 1. Preliminary safety analysis report, Amendment 20 (includes final safety analysis report, Suppl. No. 3), 25:1833 (DOCKET-50285-37)

OREGON STATE UNIV., CORVALLIS. DEPT. OF BOTANY.
Prog. rpt. on mutant studies on the photosystem II portion of the photosynthetic process, annual, 9/69--9/70, 25:2036 (RLO-2227-T-3-1)

P

PACIFIC GAS AND ELECTRIC CO., SAN FRANCISCO, CALIF.
Humboldt Bay Power Plant, Unit No. 3. Request for amendment to License No. DPR-7, 25:1816 (DOCKET-50133-41)

PARIS UNIV. (FRANCE). FACULTE DES SCIENCES.
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PARIS UNIV. (FRANCE). LABORATOIRE DE CHIMIE MINERALE.
Resistivity and magnetic susceptibility of compounds in Sn--Sm system, 25:1316 (CONF-700403-(Vol.1), pp 322-32)

PARIS UNIV., ORSAY (FRANCE). INSTITUT D'OPTIQUE.
Electron-diffraction studies on thin films of Sm_2O_3, 25:765 (CONF-700403-(Vol.1), pp 140-51)

PARIS UNIV., ORSAY (FRANCE). LABORATOIRE DE L'ACCELERATEUR LINEAIRE.
Measurement of the radiative decay modes of phi^0 meson phi^0 + eta$^0\gamma$, phi^0 + $\pi^0\gamma$ with the Orsay storage ring, 25:1411 (LAL-1240)

PARKE MATHEMATICAL LABS., INC., CARLISLE, MASS.
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PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. MATERIALS RESEARCH LAB.
Studies of the divalent oxides of the rare earths, 25:744 (CONF-700403-(Vol.1), pp 366-74)
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PENNSYLVANIA UNIV., PHILADELPHIA. DEPT. OF PHYSICS.
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PHILADELPHIA ELECTRIC CO., PA.
Limerick Generating Station, Units 1 and 2. Applicant's environmental report, construction permit stage, 25:1838 (DOCKET-50352-8)

PHILIPS GLOEILAMPENFABRIEKEN N. V., EINDHOVEN (NETHERLANDS). FORSCHUNGSLABORATORIUM.
Magnetic susceptibility and NMR of RCu_5 compounds, 25:1312 (CONF-700403-(Vol.1), pp 53-62)

PITTSBURGH UNIV., PA. DEPT. OF CHEMISTRY.
Electrical resistivities of intermetallic compounds $CeAl_3$ and $CeAl_2$, 25:1318 (CONF-700403-(Vol.1), pp 355-64)
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PITTSBURGH UNIV., PA. DEPT. OF PHYSICS.
Renormalization, diagrams and gage invariance, 25:1599 (NYO-3829-55)

POWER REACTOR DEVELOPMENT CO., DETROIT, MICH.
Enrico Fermi Atomic Power Plant, Unit 1. Amended request for authorization of Change No. 15 in the technical specifications, 25:1814 (DOCKET-50016-85)
Enrico Fermi Atomic Power Plant, Unit 1. Establishment

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Enrico Fermi Atomic Power Plant, Unit 1. Operations report, July 1970, 25:1794 (DOCKET-50016-86)

PRINCETON UNIV., N. J. ELEMENTARY PARTICLES LAB.
Measurement of the neutral branching ratios of the eta meson. technical report no. 2, 25:1367 (PURC-4159-6)
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PRINCETON UNIV., N.J. JOSEPH HENRY LABS.
J-plane phenomena in weak interactions, 25:1466 (CONF-691202-, Paper 5)

PURDUE UNIV., LAFAYETTE, IND.
Nonleptonic decay and the current x current theory, 25:1469 (UH-511-73-70)

PURDUE UNIV., LAFAYETTE, IND. DEPT. OF PHYSICS.
Double-Regge pole analysis of $\pi^+p \to \pi^+f^0p$ at 13.1 GeV/c, 25:1525 (COO-1428-237)

R

REACTOR CENTRUM NEDERLAND, PETTEN.
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RICE UNIV., HOUSTON, TEX.
Prog. rpt. on endocrine and metabolic studies utilizing radioisotopes and labeled hormones, final, 1970, 25:2044 (TID-25460)

ROCHESTER GAS AND ELECTRIC CORP., N. Y.
Robert Emmett Ginna Nuclear Power Plant, Unit No. 1. Additional information on furnace-sensitized stainless steel valves, 25:1827 (DOCKET-50244-53)
Robert Emmett Ginna Nuclear Power Plant, Unit No. 1. Malfunction of containment sump valve, 25:1800 (DOCKET-50244-52)

ROCKEFELLER UNIV., NEW YORK.
Nucleocapsid protein subunits of SV5, Newcastle disease virus and Sendai virus, 25:2022 (NYO-3983-19)

ROME UNIV. (ITALY). ISTITUTO DI FISICA.
Generating functionals, Ward identities, and scalar mesons, 25:1496 (AD-705549)
High-energy behavior of resonance poles in complex plane, 25:1639 (AD-705548)
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RUHR UNIV., BOCHUM (WEST GERMANY). INSTITUT FUER EXPERIMENTALPHYSIK.
Properties of intermetallic compounds in system Y--Fe--Co, 25:1308 (CONF-700403-(Vol.1), pp 11-20)

RUTHERFORD HIGH ENERGY LAB., CHILTON (ENGLAND).
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SAXTON NUCLEAR EXPERIMENTAL CORP., PA.
Saxton Reactor. License No. DPR-4. Information requested concerning furnace sensitized stainless steel components, 25:1783 (DOCKET-50146-66)
Saxton Reactor. License No. DPR-4; technical specifications Change Request No. 40, 25:1817 (DOCKET-50146-64)
Saxton Reactor. Operating experience report, March 1--August 31, 1970, 25:1795 (DOCKET-50146-65)

SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Effects of radiation on canine locomotion, 25:580 (AD-708431)

SCIENTIFIC RESEARCH ATOMIC REACTOR INST., MELEKESS (USSR).
Constant base line restorer and overlapping rejecting circuit for high-precision amplitude spectrometers with RC-CR formation, 25:371 (SRARI-P-67)
Investigation of radiation energy releases in experimental channels of the SM-2 reactor, 25:1939 (SRARI-P-69)

SCRIPPS CLINIC AND RESEARCH FOUNDATION, LA JOLLA, CALIF. DEPT. OF MICROBIOLOGY.
Prog. rpt. on activities of nucleic acids as a genetic probe, final, 9/70, 25:2047 (TID-25568)

SHINETSU CHEMICAL CO., TOKYO (JAPAN).
Analysis of the elution system of rare earths with chelating agent as eluent, 25:201 (CONF-700403-(Vol.1), pp 293-304)

SLOAN-KETTERING INST. FOR CANCER RESEARCH, NEW YORK.
Prog. rpt. on biological and clinical dosimetry, annual, 7/69--6/70, 25:370 (NYO-3510-15)

SOCIETA RICERCHE IMPIANTI NUCLEARI, SALUGGIA (ITALY).
Neutron streaming through cylindrical ducts with two bends in water, 25:1874 (EUR-4498)

SOCIETA RICERCHE IMPIANTI NUCLEARI, SALUGGIA (ITALY). CENTRO RICERCHE NUCLEARI.
Forced convection burnout and hydrodynamic instability experiments for water at high pressure. VII, 25:323 (EUR-4514)

SOCIETE RATEAU, LA COURNEUVE (FRANCE).
Circuit gas bearing circulators for Dragon reactor, 25:1879 (DP-Report-229)

SOUTHERN CALIFORNIA EDISON CO., LOS ANGELES.
San Onofre Nuclear Generating Station, Unit 1. Complete information on sensitized stainless steel materials, 25:1820 (DOCKET-50206-93)

SPERRY GYROSCOPE CO. LTD., BRENTFORD (ENGLAND).
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STANFORD LINEAR ACCELERATOR CENTER, CALIF.
Measurement of the two photon decay of the K/sub L/^{0} meson, 25:1385 (SLAC-125)

STANFORD RESEARCH INST., MENLO PARK, CALIF.
Oxidation mechanism of Zr, 25:615 (AD-708573)

STANFORD UNIV., CALIF. DEPT. OF MATERIALS SCIENCE.
Prog. rpt. on application of controlled electromagnetic forces during solidification of stainless steel, 6--9/70, 25:2041 (SU-326-P-29-5)

STANFORD UNIV., CALIF. HIGH-ENERGY PHYSICS LAB.
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STATE UNIV. OF NEW YORK, STONY BROOK. COLL. OF ENGINEERING.
Correlation of dislocation structure with microstrain damping in copper crystals, 25:2023 (NYO-4073-2)

STATE UNIV. OF NEW YORK, STONY BROOK. DEPT. OF PHYSICS.
Axiomatic quantum field theory and scattering of elementary particles, 25:1594 (AD-706929)

STRASBOURG UNIV. (FRANCE). FACULTE DES SCIENCES.
Effects of nuclear transformations of Xe in aqueous XeO_3 solutions, 25:195 (NP-16396)

STRASBOURG UNIV. (FRANCE). INSTITUT DE RECHERCHES NUCLEAIRES.
Scattering of high-energy electrons by ^{14} ^{15}N, 25:1709 (AD-707999)

SYLVANIA ELECTRIC PRODUCTS, INC., TOWANDA, PA.
Use of organophosphorus compounds in separation of the rare earths, 25:206 (CONF-700403-(Vol.2), pp 802-13)

SYRACUSE UNIV., N. Y. DEPT. OF BACTERIOLOGY AND BOTANY.
Prog. rpt. on fine structure, biochemistry, and control of bacterial sporogenesis, annual, 1/1/70--12/31/70, 25:2010 (NYO-2038-7)

SYRACUSE UNIV., N. Y. DEPT. OF PHYSICS.
Continuous representations and the kernel function, 25:2042 (SU-1206-227)
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TECHNISCHE HOCHSCHULE, MUNICH (WEST GERMANY). INSTITUT FUER MESS- UND REGELUNGSTECHNIK.
Analytical model for investigation of the dynamic behavior of pressurized-water reactors with self-maintained pressure, 25:1956 (MRR-60)
Comparison of the survival probability of reactor safety systems without consideration of repairs, 25:1898 (MRR-57)
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TECHNISCHE HOGESCHOOL, EINDHOVEN (NETHERLANDS).
Thermotransport of O and N in β-Zr, β-Ti, Nb, and Ta, 25:653 (NP-18486)

TELEDYNE MATERIALS RESEARCH CO., WALTHAM, MASS.
Connecticut Yankee Atomic Power Plant. Effect of oil and extinguisher material on reactor-coolant piping and pump at Connecticut-Yankee. Technical report E-1344, 25:1822 (DOCKET-50213-80)

TENNESSEE UNIV., KNOXVILLE.
Decay of neutron deficient nuclides of mass 89, 25:1720 (TID-25547)
Optimum binary signals for frequency response testing, 25:1965 (ORNL-TM-3198)

TENNESSEE UNIV., KNOXVILLE. DEPT. OF CHEMISTRY.
Research concerning ionic and free radical reactions in radiation chemistry. Progress report, September 15, 1969--September 15, 1970, 25:130 (ORO-2968-56)

TENNESSEE UNIV., MEMPHIS.
Prog. rpt. on origin and fate of thiocyanate ion in metabolism, annual, 5/1/68--4/30/69, 25:2029 (ORO-1637-16)

TOHOKU UNIV., SENDAI (JAPAN).
Analysis of the elution system of rare earths with chelating agent as eluent, 25:201 (CONF-700403-(Vol.1), pp 293-304)

TOULOUSE UNIV. (FRANCE).
Radionuclide determination by successive short sampling method, 25:367 (CEA-R-4048)

TOULOUSE UNIV. (FRANCE). FACULTE DES SCIENCES.
Dielectric alkane--carbon tetrachloride mixtures under x and gamma irradiation: application to x-ray dosimetry, 25:438 (NP-18481)
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Germanic	ä	appears as ae
Germanic	ö	oe
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SUBJECT INDEX

Cross references are included in cumulative subject indexes and in *Subject Headings Used by the USAEC Division of Technical Information* (USAEC report TID-5001).

The reader is also referred to *Guide to Abstracting and Indexing for Nuclear Science Abstracts* (USAEC report TID-4576).

Most headings in the subject index are specific materials, things, and processes. The headings are followed by modifiers that describe the properties of, or processes applied to, the headings.

All index entries cite *NSA* volume and abstract numbers; volume number precedes the colon and the abstract number follows it. The designation (R) following the abstract number indicates a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. Report numbers, where applicable, are included in parentheses after the abstract number of the citation. Published literature (journal article or book) can be identified by the absence of a report number.

Ideas presented in the original literature, rather than key words, have been indexed. The indexers have selected what seemed the most probable and logical place to look for typical information. Since it is not always possible to anticipate where a user would look for information, the cumulative indexes include numerous cross references. Consideration of synonymous or closely related terms will prove valuable.

Information is indexed for the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use or to the general class headings that include the specific headings. For example, information on boiler design for the Fermi Fast Breeder Reactor would be indexed under the headings BOILERS and FERMI FAST BREEDER REACTOR but not necessarily under the headings REACTORS, FAST or REACTORS, BREEDER.

General or broad headings are reserved for general summaries, reviews, comprehensive reports, and similar literature.

Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings; e.g., AMINO ACIDS rather than ACIDS, AMINO; HELIUM ISOTOPES He-4 rather than HELIUM—ISOTOPES He-4 or HELIUM—He-4 ISOTOPES. Note, however, that in some cases parenthetic modifying terms or inverted headings such as NEUTRONS, FAST, are used where the alphabetical arrangement of a direct entry would cause information to be scattered. In addition, organic compounds are usually entered in the index in the inverted form to facilitate grouping like or related compounds with the parent compounds; e.g., BENZENE, BROMO- rather than BROMOBENZENE. In general, the nomenclature used is that of the subject indexes to *Chemical Abstracts*.

Alphabetization

Subject headings are alphabetized word by word. Parenthetic qualifiers, numbers, and Greek letters within subject headings are disregarded in alphabetizing unless there are two or more headings that are otherwise identical, in which case the qualifier, numerical progression, or spelled names for the Greek letters determine the order.

Examples:

M-Capture
  see ELECTRON CAPTURE
MAGNESIUM
MAGNESIUM ALLOYS AND SYSTEMS
MANGANESE FLUORIDES
MANGANESE FLUORIDES MnF_2
MESONS
MESONS (π)
MESONS (ρ)
1-PENTANOL
2-PENTANOL

Modifying Phrases

The modifiers appearing under a subject heading are written specifically to show the relation between the item being indexed and the heading. The modifier therefore contains a maximum of useful information. Although the modifier begins with the word judged to be of greatest use to the greatest number of users, there is still need for the searcher to consider all modifiers under the heading(s) of interest.

Modifiers usually form meaningful phrases when combined with the subject heading. Some are intended to be read following the subject heading, e.g., the entry HYDROGEN—sorption by charcoal should be read "hydrogen sorption by charcoal." As a result of placing the important word first, however, many modifiers must be rearranged for smooth reading, e.g., FORMALDEHYDE—yields in radiolysis of ethyl ether, effects of deuterium on, should be read "effects of deuterium on formaldehyde yields in radiolysis of ethyl ether" and URANIUM—crystal structure of, effect of cooling rate on allotropic transformations in, should be read "effect of cooling rate on allotropic transformations in crystal structure of uranium."

Special characters are added to modifiers in the fields of physics and reactor technology; if the modifier does not establish the experimental or theoretical character of a reference, a symbol (E), (T), or (E/T) is placed immediately after the modifying phrase and before the abstract number.

Physical States and Configurations of Materials

The specific physical state, if other than normal, or the geometric configuration of the material is included in the modifying phrase; e.g., information on liquid metals is indexed under the specific metal with "liquid" in the modifier and carbon crucibles is indexed under CARBON with "crucibles" appropriately placed in the modifier. The information on carbon crucibles is also indexed under CRUCIBLES.

Nomenclature of Inorganic Compounds

Inorganic compounds are indexed to subject headings in the direct form. Cations are listed in the order of increasing valence for polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., SODIUM ALUMINUM SILICATES and POTASSIUM SODIUM SULFATES. If more than one anionic species is presented in a compound, the anions are arranged alphabetically, e.g., BERYLLIUM FLUORIDE HYDROXIDES.

Nomenclature of Organic Compounds

Organic compounds are indexed by subject headings based on the indexes to *Chemical Abstracts* except in the area of enzymes, in which specific enzymes, named according to the 1964 recommendations of the International Union of Biochemistry, are used. In many cases nonproprietary names for drugs are used as subject headings, and cross references are made from the systematic chemical names. Subject headings for hormones appear in the inverted style at HORMONES.

Nomenclature of Life Sciences

Subject headings for plants are names of phyla with one exception: members of the Phylum Tracheophyta are indexed under class or subclass names. Scientific names (genus and species) are used as the initial, or file, word in the modifying phrase. Scientific names are omitted only when the name is not available in the literature or cannot be found in available references.

Subject headings for animals are the names of phyla with the following exceptions: (1) members of Phylum Arthropoda and Phylum Chordata are indexed under appropriate class name, and (2) common names are used for members of Class Mammalia.

Subject headings are entered for various classes of commodities, and specific products are identified in the file-word position of the modifier. In the following examples, approved subject headings are capitalized and typical modifier file words are listed in lower case.

Example 1	Example 2
CEREALS	MEATS
bread	beef
flour	fish
oats	mutton
rice	pork
rye	poultry
wheat	seafood

Diseases, pathological conditions, and in vitro studies of atypical cells and tissues are indexed under subject headings for the organism affected, under the appropriate anatomical structure of physiological phenomenon affected, and under the appropriate disease heading. Subject headings for diseases (defined as any deviation from the norm) are DISEASES; DISEASES, INFECTIOUS; DISEASES, NEOPLASTIC; DISEASES, PHYSIOLOGICAL; DISEASES, PLANT; and DISEASES, TRAUMATIC.

Diseases of mixed etiology are treated in the following manner: neoplastic diseases that are also classified as infectious or physiological are indexed under DISEASES, NEOPLASTIC; diseases in which a microorganism is the etiologic agent are classified under DISEASES, INFECTIOUS; physiological anomalies that are neither neoplastic nor infectious are indexed under DISEASES, PHYSIOLOGICAL; the acute radiation syndrome, nonspecific radiation injuries, trauma, and wounds or incisions inflicted mechanically are indexed under DISEASES, TRAUMATIC.

Specific diseases or pathological conditions are named in the file-word position of the modifier, in the author's terminology, and are set off from the remainder of the modifier by commas. Neoplasms are designated as benign or malignant in the file-word position when more specific information is not available.

Multicomponent Alloys and Other Systems

Multicomponent alloys and systems, except well-known trade names, are indexed under a subject heading for each component in the form "element systems" for nonmetals or "element alloys and systems" for metals. The modifier begins with element symbols for each component arranged alphabetically. In addition, if significance is placed on the base metal of the alloy, this is indicated by adding "-base" to the element symbol.

Example: A 1.5C, 12Cr, 0.25V, 0.8Mo, bal Fe alloy is indexed as

```
CARBON SYSTEMS
  C--Cr--Fe-base--Mo--V, ...
CHROMIUM ALLOYS AND SYSTEMS
  C--Cr--Fe-base--Mo--V,...
IRON ALLOYS AND SYSTEMS
  C--Cr--Fe-base--Mo--V, ...
MOLYBDENUM ALLOYS AND SYSTEMS
  C--Cr--Fe-base--Mo--V, ...
VANADIUM ALLOYS AND SYSTEMS
  C--Cr--Fe-base--Mo--V, ...
```

Well-known alloys, such as ZIRCALOY-2, are indexed under the trade name; cross references from each component of the alloy to the trade name appear in cumulative indexes.

Multicomponent systems in which nonmetallic elements are present in large percentage and which are commonly referred to as systems or mixtures are indexed in a manner similar to alloys.

Example: A tungsten–silicon preparation is indexed as

```
TUNGSTEN ALLOYS AND SYSTEMS
  Si--W, ...
SILICON SYSTEMS
  Si--W, ...
```

Multicompound systems and mixtures of inorganic compounds are indexed under the subject heading for each component compound; the modifiers begin with an alphabetical listing of compound formulas.

Example: A lead titanate–lead zirconate mixture is indexed as

```
LEAD TITANATES
  PbTiO3--PbZrO3
LEAD ZIRCONATES
  PbTiO3--PbZrO3
```

A mixed system of compounds and elements is indexed by a combined form of the preceding conventions; e.g., a dispersion of copper and alumina would be indexed as

ALUMINUM OXIDES
  Al_2O_3--Cu, ...
COPPER ALLOYS AND SYSTEMS
  Al_2O_3--Cu, ...

Mixtures of organic compounds are indexed under subject headings for each component of the mixture; the modifiers begin with an alphabetical listing of compound names.

Example:

ACETIC ACID
  acetic acid--BF_3, ...
BORON FLUORIDES
  acetic acid--BF_3, ...

Example:

BENZENE, CHLORO-
  bromophenol--chlorobenzene, ...
PHENOL, BROMO-
  bromophenol--chlorobenzene, ...

If modifiers for alloys and systems are included with other modifiers under the same subject heading, they are filed last.

Example:

CARBON SYSTEMS
  deposition on nuclear fuel particles
  molecular structure of
  neutron total cross section for
  sorptive properties for xenon
  Young's modulus for
  Al--C--Cr, superconductivity in
  B--C, phase studies for
  C--U--Zr, fabrication and physical properties of

Nomenclature of High Energy Physics

Information on particle-particle events is indexed under subject headings for the specific particles involved. The modifier file word *interactions* is followed by the specific interaction written in symbolic form. Particle nomenclature and symbols follow that of Rosenfeld, et al. *Data on Particles and Resonant States*, UCRL-8030 (latest revision). For consistency the incident particle is always written first. The mass (in MeV) of a resonance state is included in parentheses after the symbol to avoid ambiguity. Hyperfragments are indicated in modifiers as in the following examples: Λ-He^5, Σ-H^3, $\Lambda\Lambda$-Be^{10}. The superscript on the right indicates the total number of baryons in the composite system.

Examples:

MESONS (π^-)
  interactions $\pi^- + p \rightarrow \Lambda + K^+ + \pi^-$ at 6 GeV/c in hydrogen bubble chamber, ΛK(1700) enhancement in, (E)
BARYONS, RESONANCE (N*)
  production of $\Delta^{++}(1236)$ and $\Delta^0(1236)$ from $K^- + p \rightarrow K^- + p + \pi^+ + \pi^-$ interactions at 2.63 and 2.70 GeV/c, (E)
HYPERFRAGMENTS
  binding energy of $\Lambda\Lambda$-He^6, three-body α--Λ--Λ model for

Subject headings are also provided for specific models and theories.

Examples:

ELEMENTARY PARTICLE MODELS (TRIPLET)
  hadron total cross sections in quark, numerical analysis of
CURRENT ALGEBRA
  PCAC hypothesis for A_1 and rho dominance in $\pi \rightarrow e + \nu + \gamma$ decay
REGGE POLE THEORY
  predictions for polarization in $K^- + p \rightarrow$ anti $K^0 + n$, $\pi^- + p \rightarrow \pi^0 + n$, and $\pi^- + p \rightarrow$ eta + n interactions at high energies
SYMMETRY GROUPS
  SU(2) × SU(4) intermediate-coupling model for nucleon and hyperon isobars

Nomenclature of Reactor Technology

Subject headings for reactors are of three types:

(1) Specific reactors, e.g., ARGONNE RESEARCH REACTOR, SAXTON POWER REACTOR

(2) Reactors having a common physics or engineering characteristic, e.g., REACTORS, FAST; REACTORS, ORGANIC-COOLED; REACTORS, PRESSURIZED-WATER

(3) Reactors having a common purpose, e.g., REACTORS, POWER; REACTORS, RESEARCH

Information on specific reactors, type (1), is indexed under the one specific subject heading. Information on classes or types of reactors, types (2) (characteristics) and (3) (purpose), is indexed under all applicable headings. For example, information on a heavy-water-moderated organic-cooled power reactor is indexed under REACTORS, HEAVY WATER-MODERATED; REACTORS, ORGANIC-COOLED; and REACTORS, POWER.

Subject headings exist for selected reactor components, e.g., REACTOR FUEL ELEMENTS. When applicable, headings for components are indexed even though they may have been included in a modifier under a type (1) or (2) heading. The materials in reactor components are indexed when the information is peculiar to the material.

Modifier file words under reactor headings are of two primary types: one type expresses reactor characteristics, e.g., reactivity; the other, components, e.g., control rod. If no subject heading appears for a reactor component, the heading REACTORS is used, and the component is used as the modifier file word.

XUM

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If published proceedings are received after the receipt of individual papers, the complete proceedings will be abstracted and the abstract number will appear in this index with the base CONF number.

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1195-196	25-1407	Dep. NTIS
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1198-744	25-1260	Dep. NTIS
1198-756	25-1985	Dep. NTIS
1198-760	25-1986	Dep. NTIS
1198-762	25-1987	Dep. NTIS
1248-21	25-1988	Dep. NTIS
1248-24	25-1989	Dep. NTIS
1265-89	25-1745	Phys. Lett.; 32B: 270-2(6 Jul 1970)
1289-21	25-1990	Dep. CFSTI
1428-237	25-1525	Dep. NTIS
1469-174	25-1991	Dep. NTIS
1617-24	25-187	Dep. CFSTI
1617-26	25-128	Dep. CFSTI
1700-11	25-688	Dep. NTIS
1700-16	25-1992	Dep. NTIS
1700-17	25-1993	Dep. NTIS
1713-16	25-188	Dep. NTIS
1721-21	25-1994	Dep. NTIS
1750-1	25-1995	Dep. CFSTI
2011-3	25-1996	Dep. NTIS
CSIRO-Trans-	(Australian)	
10089	25-48	Dep. NTIS (U. S. Sales Only)
CSR-TR-	(Non-AEC)	
70-5	25-854	See N-70-35168
CTC-		
15(Rev.1)	25-1997	Dep. NTIS
D-	(Misc.)	
2-125680-3	25-480	See N-70-32919
2-126203-3	25-479	See N-70-31746
DESY-	(German)	
70/30	25-1595	Dep. NTIS (U. S. Sales Only)
70/31	25-1361	Dep. NTIS (U. S. Sales Only)
70/33	25-1362	Dep. NTIS (U. S. Sales Only)
70/36	25-1363	Dep. NTIS (U. S. Sales Only)
70/39	25-1364	Dep. NTIS (U. S. Sales Only)
70/40	25-1365	Dep. NTIS (U. S. Sales Only)
70/41	25-965	Dep. NTIS (U. S. Sales Only)
70/42	25-1366	Dep. NTIS (U. S. Sales Only)
70/43	25-1596	Dep. NTIS (U. S. Sales Only)
70/44	25-1440	Dep. NTIS (U. S. Sales Only)
DLR-FB-	(German)	
69-66	25-2040	For translation see SC-T-70-4038
DMIC-	(Non-AEC)	
222	25-626	See AD-480455
230	25-648	See AD-487626
239	25-627	See AD-821672
DMIC-Memo-	(Non-AEC)	
207	25-645	See AD-474255
210	25-740	See AD-474854
213	25-647	See AD-487419
DOCKET-1155-		(LaCrosse Boiling Water Reactor) (AEC)
83	25-1811	Dep. NTIS
DOCKET-50003-		(Indian Point Station; See Also DOCKET-50247, DOCKET-50286) (Non-AEC)
57	25-1812	Dep. NTIS
58	25-1780	Dep. NTIS
DOCKET-50016-		(Enrico Fermi Atomic Power Plant) (Non-AEC)
84	25-1813	Dep. NTIS
85	25-1814	Dep. NTIS
86	25-1794	Dep. NTIS
DOCKET-50029-		(Yankee Atomic Electric Co.) (Non-AEC)
137	25-1815	Dep. NTIS
138	25-1781	Dep. NTIS
139	25-1782	Dep. NTIS
DOCKET-50133-		(Humboldt Bay Power Plant) (Non-AEC)
41	25-1816	Dep. NTIS
DOCKET-50146-		(Saxton Nuclear Experimental Corporation) (Non-AEC)
64	25-1817	Dep. NTIS
65	25-1795	Dep. NTIS
66	25-1783	Dep. NTIS
DOCKET-50155-		(Big Rock Point Reactor) (Misc.)

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51	25-1818	Dep. NTIS
52	25-1819	Dep. NTIS
DOCKET-50184-	(National Bureau of Standards Reactor) (Non-AEC)	
23	25-1920	Dep. NTIS
DOCKET-50201-	(West Valley Reprocessing Plant--Formerly Spent Fuel Processing Plant) (Misc.)	
48	25-258	Dep. NTIS
49	25-259	Dep. NTIS
50	25-208	Dep. NTIS
DOCKET-50206-	(San Onofre Nuclear Generating Station) (Non-AEC)	
93	25-1820	Dep. NTIS
DOCKET-50213-	(Connecticut Yankee Atomic Power Plant) (Misc.)	
79	25-1821	Dep. NTIS
80	25-1822	Dep. NTIS
81	25-1796	Dep. NTIS
DOCKET-50219-	(Oyster Creek Nuclear Power Plant) (Non-AEC)	
113	25-1784	Dep. NTIS
114	25-1797	Dep. NTIS
DOCKET-50220-	(Nine Mile Point Nuclear Station) (Non-AEC)	
50	25-1823	Dep. NTIS
51	25-1824	Dep. NTIS
DOCKET-50237-	(Dresden Nuclear Power Station, See also DOCKET-50249) (Non-AEC)	
81	25-1825	Dep. NTIS
82	25-1798	Dep. NTIS
83	25-1826	Dep. NTIS
84	25-1799	Dep. NTIS
DOCKET-50238-	(N.S. Savannah Safety Assessment) (Non-AEC)	
73	25-1948	Dep. NTIS
DOCKET-50244-	(Robert Emmett Ginna Nuclear Power Plant, Formerly Brookwood Nuclear Station) (Non-AEC)	
52	25-1800	Dep. NTIS
53	25-1827	Dep. NTIS
DOCKET-50245-	(Millstone Point Nuclear Power Station) (Non-AEC)	
41	25-1828	Dep. NTIS
DOCKET-50249-	(Dresden Nuclear Power Station; See also DOCKET-50237) (Non-AEC)	
42	25-1825	See DOCKET-50237-81
DOCKET-50250-	(Turkey Point, See also DOCKET-50251) (Non-AEC)	
32	25-1829	Dep. NTIS
33	25-1785	Dep. NTIS
34	25-1830	Dep. NTIS
DOCKET-50251-	(Turkey Point, See also DOCKET-50250) (Non-AEC)	
30	25-1829	See DOCKET-50250-32
31	25-1785	See DOCKET-50250-33
32	25-1830	See DOCKET-50250-34
DOCKET-50254-	(Quad-Cities Station; See also DOCKET-50265) (Non-AEC)	
21	25-1786	Dep. NTIS
DOCKET-50261-	(H. B. Robinson) (Non-AEC)	
44	25-1831	Dep. NTIS
45	25-1801	Dep. NTIS
DOCKET-50266-	(Point Beach Nuclear Plant) (Non-AEC)	
30	25-1802	Dep. NTIS
31	25-1832	Dep. NTIS
DOCKET-50269-	(Oconee Nuclear Station, See also DOCKET-50270, and DOCKET-50287) (Non-AEC)	
27	25-1803	Dep. NTIS
DOCKET-50270-	(Oconee Nuclear Station, See also DOCKET-50269, and DOCKET-50287) (Non-AEC)	
27	25-1803	See DOCKET-50269-27
DOCKET-50285-	(Fort Calhoun Station) (Non-AEC)	
37	25-1833	Dep. NTIS
DOCKET-50287-	(Oconee Nuclear Station; see also DOCKET-50269 and DOCKET-50270) (Non-AEC)	
24	25-1803	See DOCKET-50269-27
DOCKET-50301-	(Point Beach Nuclear Plant) (Non-AEC)	
25	25-1832	See DOCKET-50266-31
DOCKET-50317-	(Calvert Cliffs Nuclear Power Plant, See also DOCKET-50318) (Non-AEC)	
19	25-1834	Dep. NTIS
DOCKET-50318-	(Calvert Cliffs Nuclear Power Plant, See also DOCKET-50317) (Non-AEC)	
19	25-1834	See DOCKET-50317-19
DOCKET-50338-	(North Anna Power Station; See also DOCKET-50339) (Non-AEC)	
25	25-1835	Dep. NTIS
DOCKET-50339-	(North Anna Power Station; See also DOCKET-50338) (Non-AEC)	
24	25-1835	See DOCKET-50338-25
DOCKET-50348-	(Joseph M. Farley Nuclear Plant, Units 1 and 2, Formerly Seala Nuclear Plant, See also DOCKET-50364) (Non-AEC)	
12	25-1836	Dep. NTIS
13	25-1837	Dep. NTIS
DOCKET-50352-	(Limerick Generating Station) (See also DOCKET-50353) (Non-AEC)	
8	25-1838	Dep. NTIS
DOCKET-50353-	(Limerick Generating Station) (See also DOCKET-50352) (Non-AEC)	
8	25-1838	See DOCKET-50352-8
DOCKET-50358-	(Wm. H. Zimmer Nuclear Power Station, Units 1 and 2) (See also DOCKET-50359) (Non-AEC)	
7	25-1839	Dep. NTIS
DOCKET-50359-	(Wm. H. Zimmer Nuclear Power Station, Units 1 and 2) (See also DOCKET-50358) (Non-AEC)	
6	25-1839	See DOCKET-50358-7
DOCKET-50364-	(Joseph M. Farley Nuclear Plant, Units 1 and 2, See also DOCKET-50348) (Non-AEC)	
6	25-1836	See DOCKET-50348-12
7	25-1837	See DOCKET-50348-13
DOCKET-50372-	(Atlantic Richfield Company) (Non-AEC)	
1	25-209	Dep. NTIS
2	25-210	Dep. NTIS
DOCKET-50373-	(LaSalle County Station Units 1 and 2) (See also DOCKET-50374) (Non-AEC)	
1	25-1840	Dep. NTIS
2	25-1841	Dep. NTIS
3	25-1842	Dep. NTIS
4	25-1843	Dep. NTIS
5	25-1844	Dep. NTIS
DOCKET-50374-	(LaSalle County Station Units 1 and 2) (See also DOCKET-50373) (Non-AEC)	
1	25-1840	See DOCKET-50373-1
2	25-1841	See DOCKET-50373-2
3	25-1842	See DOCKET-50373-3
4	25-1843	See DOCKET-50373-4
5	25-1844	See DOCKET-50373-5
DP-		
1236	25-211	Dep. NTIS
DP-Report-	(British)	
2	25-724	Dep. NTIS
114	25-299	Dep. NTIS
205	25-70	Dep. NTIS
209	25-745	Dep. NTIS
219	25-300	Dep. NTIS
221	25-301	Dep. NTIS
224	25-302	Dep. NTIS
229	25-1879	Dep. NTIS
251	25-303	Dep. NTIS
315	25-725	Dep. NTIS
316	25-779	Dep. NTIS
317	25-746	Dep. NTIS
318	25-726	Dep. NTIS
319	25-71	Dep. NTIS
324	25-39	Dep. NTIS
331	25-747	Dep. NTIS
419	25-719	Dep. NTIS
424	25-212	Dep. NTIS
DUN-SA-		
153	25-1951	Dep. NTIS
E-	(Misc.)	
5160	25-1926	See N-70-27514
5186	25-1967	See N-70-24799
5320	25-1944	See N-70-33276
5457	25-1943	See N-70-32250
5562	25-652	See N-70-30113
5587	25-705	See N-70-29887
5619	25-1875	See N-70-32598
5641	25-1925	See N-70-26979
5653	25-1669	See N-70-33060
5659	25-1927	See N-70-35911
ECOM-	(Non-AEC)	
3300	25-1216	See AD-709594

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EFI-		
70-51	25-1467	See COO-264-559
EGG-		
1183-3007	25-1046	Dep. NTIS
ERLTM-ARL-		
23	25-1976	See ARLV-351-13
ETR-	(Belgian)	
238	25-217	See NP-18397
249	25-218	See NP-18398
255	25-219	See NP-18399
EUR-	(European Atomic Energy Community)	
4047(Pt.2)	25-213	Dep. NTIS (U. S. Sales Only). EUR DM 6,20
4305	25-1923	See KFK-1188
4416	25-1921	Dep. NTIS (U. S. Sales Only). EUR FF 5.60
4493	25-1907	Dep. NTIS (U. S. Sales Only). EUR FF 30.60
4498	25-1874	Dep. NTIS (U. S. Sales Only). EUR FF 9.45
4507	25-618	Dep. NTIS (U. S. Sales Only). EUR FF 16,50
4514	25-323	Dep. NTIS (U. S. Sales Only). EUR Lit 750.-
EUR-CEA-FC-	(European Atomic Energy Community)	
540	25-1172	Dep. NTIS (U. S. Sales Only)
EURFNR-	(European Atomic Energy Community)	
773	25-1968	Dep. NTIS
819	25-304	Dep. NTIS (U. S. Sales Only)
821	25-1929	See RCN-122
822	25-1851	Dep. NTIS (U. S. Sales Only)
FOA-	(Swedish)	
4-4432	25-6	Dep. CFSTI (U. S. Sales Only)
FTD-HT-	(Non-AEC)	
23-241-70	25-1220	See AD-707116
FTD-MT-	(Non-AEC)	
24-12-70	25-881	See AD-707102
GA-	(Misc.)	
10219	25-481	See N-70-33998
10268	25-780	Dep. NTIS
10272	25-355	Dep. NTIS
GEAP-	(Misc.)	
10010-25	25-1922	Dep. NTIS
10028-35	25-1888	Dep. NTIS
10207	25-1880	Dep. NTIS
10214	25-324	Dep. NTIS
12114-1	25-1	Dep. NTIS
GL-		
1970-12	25-2024	See NYO-4176-3
HASL-		
236	25-437	Dep. NTIS
HEPL-	(Misc.)	
530-Rev-A	25-420	See AD-705505
586	25-1360	See AD-708409
623	25-1709	See AD-707999
HMI-B-	(German)	
99	25-1908	Dep. NTIS (U. S. Sales Only)
IDO-		
12073	25-518	Dep. CFSTI
IFVE-STF-	(Russian)	
69-106	25-1640	Dep. NTIS (U. S. Sales Only)
69-110	25-1430	Dep. NTIS (U. S. Sales Only)
70-4	25-1468	Dep. NTIS (U. S. Sales Only)
IFVE-SVM-	(Russian)	
70-2	25-1441	Dep. NTIS (U. S. Sales Only)
IN-		
1348	25-1909	Dep. NTIS
1390	25-1897	Dep. NTIS
1393	25-1910	Dep. NTIS
INR-	(Non-AEC)	
1165	25-214	Dep. CFSTI (U. S. Sales Only)
1194	25-631	Dep. NTIS (U. S. Sales Only)
1197	25-1736	Dep. CFSTI (U. S. Sales Only)
INS-	(New Zealander)	
388	25-460	See NP-18408
IPP-	(Non-AEC)	
6/85	25-1242	Dep. NTIS (U. S. Sales Only)
IPST-Cat.-	(Russian)	
5658	25-295	See AEC-tr-7100
IS-		
2205	25-1998	Dep. NTIS
2327	25-7	Dep. NTIS
2410	25-1999	Dep. NTIS
IS-T-		
335	25-2000	Dep. NTIS
378	25-2001	Dep. NTIS
387	25-1320	Dep. NTIS
395	25-1321	Dep. NTIS
402	25-2002	Dep. NTIS
407	25-2003	Dep. NTIS
ITEF-	(Russian)	
734	25-421	Dep. NTIS (U. S. Sales Only)
763	25-1486	Dep. NTIS (U. S. Sales Only)
764	25-982	Dep. NTIS (U. S. Sales Only)
ITF-	(Russian)	
70-39	25-1526	Dep. NTIS (U. S. Sales Only)
70-40	25-1442	Dep. NTIS (U. S. Sales Only)
70-41	25-1443	Dep. NTIS (U. S. Sales Only)
70-55	25-1572	Dep. NTIS (U. S. Sales Only)
IYAF-	(Russian)	
2-70	25-1666	Dep. NTIS (U. S. Sales Only)
JAERI-	(Japanese)	
1194	25-1953	Dep. NTIS (U. S. Sales Only)
JAERI-Memo-	(Japanese)	
4106	25-41	Dep. NTIS (U. S. Sales Only)
4114	25-1873	Dep. NTIS (U. S. Sales Only)
JINR-	(Russian)	
E2-5225	25-1444	Dep. NTIS (U. S. Sales Only)
E2-5226	25-1527	Dep. NTIS (U. S. Sales Only)
E2-5282	25-1552	Dep. NTIS (U. S. Sales Only)
P1-5209	25-1675	For translation see UCRL-Trans-1419
P1-5236	25-1409	Dep. NTIS (U. S. Sales Only)
P1-5326	25-1410	Dep. NTIS (U. S. Sales Only)
P1-5340	25-1497	Dep. NTIS (U. S. Sales Only)
P1-5357	25-422	Dep. NTIS (U. S. Sales Only)
P2-5302	25-1528	Dep. NTIS (U. S. Sales Only)
P2-5304	25-1597	Dep. NTIS (U. S. Sales Only)
P3-4783	25-1439	For translation see BNL-tr-372
P9-5246	25-1667	Dep. NTIS (U. S. Sales Only)
P9-5312	25-1668	Dep. NTIS (U. S. Sales Only)
JPL-TR-	(Non-AEC)	
32-1427	25-478	See N-70-27140
K-L-		
6257	25-215	Dep. NTIS
KAPL-M-		
7131	25-2004	Dep. NTIS
KFK-	(German)	
988	25-1849	For translation see ANL-Trans-858
1031	25-1968	For translation see EURFNR-773
1144	25-8	Dep. NTIS (U. S. Sales Only)
1173	25-961	Dep. NTIS (U. S. Sales Only)
1184	25-459	Dep. NTIS (U. S. Sales Only)
1188	25-1923	Dep. NTIS (U. S. Sales Only)
1203	25-304	See EURFNR-819
1216	25-1395	Dep. NTIS (U. S. Sales Only)
1257	25-181	Dep. NTIS (U. S. Sales Only)
KFKI-	(Hungarian)	
70-13-RPT	25-1955	Dep. CFSTI (U. S. Sales Only)
KURRI-TR-	(Non-AEC)	
58	25-342	Dep. NTIS (U. S. Sales Only)
LA-		
4462-TR	25-748	Dep. NTIS
4473	25-1924	Dep. NTIS
4475	25-2005	Dep. NTIS
4477	25-2006	Dep. NTIS
4495	25-727	Dep. NTIS
4515	25-2007	Dep. NTIS
4523	25-356	Dep. NTIS
LA-DC-		
9769	25-754	J. Chem. Eng. Data; 14: 244-6(Apr 1969)
LA-tr-		
70-19	25-1189	Dep. NTIS
LAL-	(French)	
1240	25-1411	Dep. NTIS (U. S. Sales Only)
LF-	(Misc.)	
29	25-129	See NP-18478
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44	25-2008	Dep. NTIS

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LYCEN-	(French)	
7013	25-1718	Dep. CFSTI (U. S. Sales Only)
7014	25-1737	Dep. CFSTI (U. S. Sales Only)
7033	25-1711	Dep. CFSTI (U. S. Sales Only)
7046	25-1641	Dep. NTIS (U. S. Sales Only)
7051	25-1738	Dep. NTIS (U. S. Sales Only)
MLM-		
1726	25-216	Dep. NTIS
1743	25-72	Dep. NTIS
1757	25-330	Dep. NTIS
1766(TR)	25-2009	Dep. NTIS
MR-	(Non-AEC)	
7002	25-353	See AD-706853
MRR-	(West German)	
57	25-1898	Dep. NTIS (U. S. Sales Only)
60	25-1956	Dep. NTIS (U. S. Sales Only)
66	25-1911	Dep. NTIS (U. S. Sales Only)
69	25-1957	Dep. NTIS (U. S. Sales Only)
N-	(Misc.)	
70-24799	25-1967	NTIS
70-26979	25-1925	NTIS
70-27140	25-478	NTIS
70-27514	25-1926	NTIS
70-27711	25-413	NTIS
70-28461	25-414	NTIS
70-29887	25-705	NTIS
70-29888	25-884	NTIS
70-30113	25-652	NTIS
70-30593	25-415	NTIS
70-31746	25-479	NTIS
70-32250	25-1943	NTIS
70-32469	25-983	NTIS
70-32499	25-786	NTIS
70-32598	25-1875	NTIS
70-32919	25-480	NTIS
70-32990	25-1021	NTIS
70-33060	25-1669	NTIS
70-33276	25-1944	NTIS
70-33998	25-481	NTIS
70-34304	25-1945	NTIS
70-35168	25-854	NTIS
70-35279	25-885	NTIS
70-35591	25-1022	NTIS
70-35911	25-1927	NTIS
NASA-CR-	(Misc.)	
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102651	25-414	See N-70-28461
108559	25-1021	See N-70-32990
109803	25-481	See N-70-33998
109848	25-413	See N-70-27711
109853	25-478	See N-70-27140
109971	25-854	See N-70-35168
110354	25-884	See N-70-29888
110496	25-479	See N-70-31746
110715	25-786	See N-70-32499
112504	25-1022	See N-70-35591
NASA-TM-X-	(Misc.)	
2012	25-1926	See N-70-27514
2019	25-705	See N-70-29887
2038	25-1943	See N-70-32250
2048	25-1875	See N-70-32598
2052	25-1669	See N-70-33060
2055	25-1944	See N-70-33276
52787	25-1925	See N-70-26979
52828	25-415	See N-70-30593
252865	25-1945	See N-70-34304
NASA-TN-D-	(Misc.)	
5737	25-1967	See N-70-24799
5873	25-652	See N-70-30113
5956	25-1927	See N-70-35911
NBS-Handbook-	(Non-AEC)	
107	25-1670	GPO $0.30
NBS-TN-	(Misc.)	
506	25-37	GPO $0.55
523	25-416	GPO $0.50
534	25-49	GPO $0.50
537	25-369	GPO $0.30
NCEL-TN-	(Non-AEC)	
950	25-616	See AD-829844
NCG-TR-	(Non-AEC)	
18	25-294	See AD-707440
NEDO-	(Non-AEC)	
10189	25-1899	Dep. NTIS
NI-	(Italian)	
242	25-1496	See AD-705549
250	25-1639	See AD-705548
NOLTR-	(Misc.)	
69-233	25-410	See AD-704786
NP-	(AEC File No. for Non-AEC Reports)	
9382	25-724	See DP-Report-2
17786	25-1189	For translation see LA-tr-70-19
18119	25-1197	For translation see AEC-tr-7163
18396	25-195	Dep. CFSTI (U. S. Sales Only)
18397	25-217	Dep. CFSTI (U. S. Sales Only)
18398	25-218	Dep. CFSTI (U. S. Sales Only)
18399	25-219	Dep. CFSTI (U. S. Sales Only)
18408	25-460	Dep. CFSTI (U. S. Sales Only)
18409	25-461	Dep. CFSTI (U. S. Sales Only)
18415	25-462	Dep. CFSTI (U. S. Sales Only)
18463	25-984	Dep. NTIS (U. S. Sales Only)
18472	25-1261	Dep. NTIS (U. S. Sales Only)
18473	25-1598	Dep. NTIS (U. S. Sales Only)
18474	25-1262	Dep. NTIS (U. S. Sales Only)
18478	25-129	Dep. NTIS (U. S. Sales Only)
18479	25-220	Dep. NTIS (U. S. Sales Only)
18481	25-438	Dep. NTIS (U. S. Sales Only)
18486	25-653	Dep. NTIS (U. S. Sales Only)
18494	25-1845	
18502	25-1163	Dep. NTIS (U. S. Sales Only)
18503	25-1217	Dep. NTIS (U. S. Sales Only)
18504	25-1243	Dep. NTIS (U. S. Sales Only)
18505	25-1236	Dep. NTIS (U. S. Sales Only)
NRL-	(Misc.)	
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NRL-MR-	(Non-AEC)	
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2126	25-702	See AD-707336
2127	25-364	See AD-707706
NSRDS-NBS-	(Non-AEC)	
34	25-966	GPO $0.75
NTS-		
224	25-2057	See USGS-474-86
NUS-	(Misc.)	
557	25-413	See N-70-27711
NVO-		
1163-195	25-286	Dep. NTIS
1163-208	25-287	Dep. NTIS
NYO-		
73-293	25-1739	Dep. CFSTI
2038-7	25-2010	Dep. NTIS
2171-321	25-1719	Dep. CFSTI
2262-TA-204	25-1608	Phys. Rev., D; 2: 1577-85(15 Oct 1970)
2262-TA-214	25-1602	J. Math. Phys. (N. Y.); 11: 2935-8(Oct 1970)
2262-TA-224	25-1529	Dep. NTIS
2391-117	25-2011	Dep. NTIS
2504-69	25-2012	Dep. NTIS
2504-77	25-2013	Dep. NTIS
2504-78	25-2014	Dep. NTIS
2798-54	25-2015	Dep. NTIS
3029-45	25-1094	Dep. NTIS
3326-29	25-2016	Dep. NTIS
3399-227	25-2042	See SU-1206-227
3399-228	25-1573	See SU-1206-228
3399-229	25-1574	See SU-1206-229
3399-230	25-1575	See SU-1206-230
3399-231	25-1531	See SU-1206-231
3510-15	25-370	Dep. CFSTI
3747-3	25-2017	Dep. NTIS
3747-5	25-2018	Dep. NTIS
3747-6	25-2019	Dep. NTIS
3747-10(Pt. 1)	25-2020	Dep. NTIS
3747-10(Pt. 2)	25-2021	Dep. NTIS
3829-55	25-1599	Dep. NTIS
3983-19	25-2022	Dep. NTIS
4073-2	25-2023	Dep. NTIS
4176-3	25-2024	Dep. NTIS
ORNL-		
4270(Vol.2)	25-614	Dep. NTIS
4606	25-1530	Dep. NTIS
ORNL-IBP-		
70-3	25-2025	Dep. NTIS
ORNL-IIC-		
21	25-261	Dep. NTIS
30(Pt.2)	25-331	Dep. NTIS
ORNL-NSIC-		
78	25-1912	Dep. NTIS
ORNL-TM-		
3093	25-1173	Dep. NTIS
3119	25-1764	Dep. CFSTI

XUM

Report No.	Abstract No.	Availability
3144	25-155	Dep. NTIS
3155	25-2026	Dep. CFSTI
3161	25-1928	Dep. NTIS
3170	25-357	Dep. NTIS
3177	25-1852	Dep. NTIS
3186	25-2027	Dep. NTIS
3198	25-1965	Dep. NTIS
ORNL-tr-		
2378	25-2028	Dep. NTIS
2387	25-781	Dep. NTIS
ORO-		
1637-16	25-2029	Dep. CFSTI
2454-14	25-1222	Dep. NTIS
2968-51	25-136	Macromolecules; 3: 264-5(Mar-Apr 1970)
2968-56	25-130	Dep. CFSTI
3603-6	25-2030	Dep. NTIS
3603-7	25-2031	Dep. NTIS
3612-7	25-706	Dep. NTIS
3736-4	25-2032	Dep. CFSTI
3781-7	25-141	Dep. NTIS
3912-3	25-707	Dep. NTIS
4025-1	25-2033	Dep. NTIS
PATENTS	(British)	
1,201,659	25-476	
1,202,543	25-475	
1,203,609	25-452	
1,203,780	25-442	
1,203,925	25-1702	
1,204,011	25-407	
1,205,550	25-451	
1,205,779	25-1185	
1,206,038	25-251	
1,206,048	25-736	
1,206,449	25-241	
1,206,503	25-240	
1,206,748	25-242	
1,206,756	25-620	
1,206,994	25-307	
1,207,288	25-239	
1,208,378	25-1884	
1,208,433	25-738	
1,208,613	25-1893	
1,208,713	25-733	
1,208,743	25-1860	
1,209,033	25-1859	
1,209,583	25-361	
1,209,632	25-1862	
1,209,780	25-755	
1,209,957	25-1882	
1,210,184	25-1900	
1,210,430	25-639	
1,210,569	25-1854	
1,210,687	25-1881	
1,210,793	25-1969	
1,210,890	25-1887	
1,211,249	25-1864	
1,211,255	25-1863	
1,211,445	25-1904	
PATENTS	(Czechoslovak)	
131,646	25-1970	
131,651	25-313	
PATENTS	(U. S.)	
3,519,942	25-1681	
3,524,056	25-467	
3,525,228	25-1686	
3,527,669	25-1858	
3,527,948	25-335	
3,529,046	25-732	
3,529,157	25-791	
3,529,158	25-457	
3,529,161	25-409	
3,530,294	25-306	
3,530,296	25-336	
PG-Report-	(British)	
991	25-358	Dep. NTIS (U. S. Sales Only)
PRDC-EF-		
83	25-1794	See DOCKET-50016-86
PURC-		
4159-6	25-1367	Dep. NTIS
4159-9	25-1384	Dep. NTIS
R-	(Misc.)	
473	25-1196	See AD-707676
RCN-	(Dutch)	
120	25-1851	See EURFNR-822
122	25-1929	
RD/B/N-	(British)	
1620	25-73	Dep. NTIS (U. S. Sales Only)
1622	25-1889	Dep. NTIS (U. S. Sales Only)
1668	25-343	Dep. NTIS (U. S. Sales Only)
1724	25-1787	Dep. NTIS (U. S. Sales Only)

Report No.	Abstract No.	Availability
1749	25-1871	Dep. NTIS (U. S. Sales Only)
RFP-		
1540	25-2034	Dep. NTIS
RHEL/R-	(British)	
196.	25-156	Dep. NTIS (U. S. Sales Only). UK 4s. 6d
202	25-344	Dep. NTIS (U. S. Sales Only). UK 3s. 6d
RLO-		
2095-2	25-2035	Dep. NTIS
2225-T-10-1	25-519	Dep. CFSTI
2227-T-3-1	25-2036	Dep. NTIS
RPP/N-	(British)	
18	25-1671	Dep. NTIS (U. S. Sales Only)
22	25-1672	Dep. NTIS (U. S. Sales Only)
RT/PROT-	(Italian)	
(69)19	25-374	G. Fis. Sanit. Prot. Radiaz.; 12: 125-33(Jul-Sep 1968)
SAM-TR-	(Non-AEC)	
70-25	25-520	See AD-708428
70-32	25-580	See AD-708431
SAMSO-TR-	(Non-AEC)	
70-225	25-411	See AD-708466
70-259	25-883	See AD-709205
SC-DR-		
70-218	25-2037	Dep. NTIS
70-560	25-332	Dep. NTIS
SC-RR-		
70-454	25-2038	Dep. NTIS
70-547	25-2039	Dep. NTIS
SC-T-		
70-4038	25-2040	Dep. NTIS
SLAC-		
125	25-1385	Dep. NTIS
SLAC-PUB-		
522	25-1360	See AD-708409
SRARI-P-	(Russian)	
67	25-371	Dep. NTIS (U. S. Sales Only)
69	25-1939	Dep. NTIS (U. S. Sales Only)
STI/DOC-	(International Atomic Energy Agency)	
10/118	25-2	IAEA $7.00
STI/PUB-	(International Atomic Energy Agency)	
255	25-262	IAEA $24.00
SU-	(Misc.)	
326-P-29-5	25-2041	Dep. NTIS
1206-227	25-2042	Dep. NTIS
1206-228	25-1573	Dep. NTIS
1206-229	25-1574	Dep. NTIS
1206-230	25-1575	Dep. NTIS
1206-231	25-1531	Dep. NTIS
TID-		
3760	25-2043	DTIE Free
4100(Suppl. 60)	25-305	DTIE Free
25460	25-2044	Dep. CFSTI
25513	25-142	Dep. CFSTI
25547	25-1720	Dep. NTIS
25554	25-619	Dep. NTIS
25558	25-1804	Dep. NTIS
25560	25-2045	Dep. NTIS
25561	25-2046	Dep. NTIS
25568	25-2047	Dep. NTIS
25571	25-1355	Dep. NTIS
TR-	(Misc.)	
59(9260-2)-1	25-883	See AD-709205
66(5260-20)-14	25-411	See AD-708466
TT-	(Misc.)	
69-50012/5	25-1973	See AEC-tr-7027/5
69-50012/6	25-1974	See AEC-tr-7027/6
69-50012/7-8	25-180	See AEC-tr-7027/7-8
70-50008	25-295	See AEC-tr-7100
UCB-	(Non-AEC)	
34-P-128-16	25-1200	Dep. NTIS
UCLA-		
10-P-14-92	25-2048	Dep. NTIS

Report No.	Abstract No.	Availability
12-792	25-157	Dep. NTIS
UCRL-		
19526	25-221	Dep. NTIS
19608	25-2049	Dep. NTIS
19625	25-2050	Dep. NTIS
19639	25-2051	Dep. NTIS
19653	25-1095	Dep. CFSTI
19662	25-2052	Dep. NTIS
19753	25-1368	Dep. NTIS
19823	25-1673	Dep. NTIS
19842	25-423	Dep. NTIS
19843	25-1532	Dep. NTIS
19844	25-1412	Dep. NTIS
20049	25-1674	Dep. NTIS
20076	25-1413	Dep. NTIS
20077	25-1396	Dep. NTIS
20078	25-1386	Dep. NTIS
20079	25-1387	Dep. NTIS
50892(Vol. 5)	25-464	Dep. NTIS
50892(Vol. 4)(Pt.3)	25-463	Dep. NTIS
50904	25-2053	Dep. NTIS
50920	25-1237	Dep. NTIS
71514	25-1676	IEEE (Inst. Elec. Electron. Eng.). Trans. Magnet.; MAG-6: 41-5(Mar 1970)
72636	25-488	Dep. NTIS
72739	25-372	Dep. NTIS
UCRL-Trans-		
1410	25-2054	Dep. NTIS
1412	25-2055	Dep. NTIS
1413	25-1096	Dep. NTIS
1418	25-1097	Dep. NTIS
1419	25-1675	Dep. NTIS
10480	25-2056	Dep. CFSTI
UCSD-		
10-P-10-76	25-1533	Dep. NTIS
UH-		
511-73-70	25-1469	Dep. NTIS
511-77-70	25-1414	Dep. NTIS
511-79-70	25-1498	Dep. NTIS
511-80-70	25-1388	Dep. NTIS
511-81-70	25-1369	Dep. NTIS
511-83-70	25-424	Dep. NTIS
511-84-70	25-1389	Dep. NTIS
511-87-70	25-1356	Dep. NTIS
UILU-ENG-	(Non-AEC)	
70-218	25-1196	See AD-707676
UNICP-SR-	(Austrian)	
71	25-1188	See AD-709230
USAMRL-	(Non-AEC)	
33	25-494	See AD-806412
155	25-365	See AD-806313
USGS-		
474-86	25-2057	Dep. NTIS
474-98	25-2058	Dep. NTIS
WANL-TR(SS)-		
6	25-333	Dep. NTIS
WAPD-TM-	(Misc.)	
926	25-345	Dep. NTIS
956	25-346	Dep. NTIS
980	25-782	Dep. NTIS
WARD-		
4135-11	25-728	Dep. NTIS
4135-12	25-654	Dep. NTIS
WASH-		
1152	25-222	Dep. NTIS
WHAN-FR-		
8	25-729	Dep. NTIS

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Appendix 1

SCOPE AND SECTION ARRANGEMENT OF NUCLEAR SCIENCE ABSTRACTS

Introduction

This appendix defines the subject scope and arrangement of the literature in *Nuclear Science Abstracts (NSA)*. Broadly stated, the subject scope of *NSA* includes all of nuclear science and technology defined as follows:

> Nuclear science is the study of the production, properties, and phenonema of atomic nuclei, subatomic particles, gamma rays, and x rays.
>
> Nuclear technology is the application of nuclear science to other sciences and engineering, and conversely, the application of other sciences and engineering to the problems of nuclear science.

Part 1 identifies the 10 major fields of nuclear science and technology into which *NSA* is divided. Subdivisions are listed under each field. Each subdivision is followed by statements of specific subject interest. These statements have been prepared to show the exact range and limits of subject interest for selecting literature abstracted and indexed in *NSA*.

Part 2 identifies the extent of interest in the chemical elements.

An index to Part 1 begins on Appendix 19.

NSA covers reports, journals, books, patents, reviews, theses, conferences, and other similar literature. Selection is based on subject content; nothing is excluded solely on the basis of form, origin, or language. Some of the general practices followed in selecting literature for *NSA* are as follows:

1. Popular type articles are not included.
2. Textbooks below the graduate level are not included.
3. Theses below the doctoral level are not included.
4. Patents that have been filed in several countries are included only once.
5. Material existing only as abstracts or short summaries are not included except for papers summarized in the *Transactions of the American Nuclear Society*.
6. Material initially published in a language other than English may be included both when an item is published in the original language and when an item appears in an English language translation.
7. All U. S. Atomic Energy Commission research and development reports in printed form which have been made publicly available at the National Technical Information Service (NTIS) are included in *NSA*. Also included in *NSA* are the printed reports from the national nuclear energy organizations of the United Kingdom, Japan, Canada, Sweden, Denmark, Norway, Australia, and France which have been made publicly available at NTIS.
8. Related groups of engineering drawings and specifications are abstracted and indexed in *NSA* when they become publicly available.
9. As a general practice, material more than two years old is not included in *NSA*.

All journals scanned regularly are listed in Issue No. 1 of each new volume. New additions are listed in issues numbered 7, 13, and 19 of each volume.

Part 1

SCOPE AND ARRANGEMENT

1.0 CHEMISTRY

1.01 Analytical Chemistry

Chemical and Spectral Procedures

Involving the actinides or lanthanides, any radioactive element, other elements as specified in Part 2 (Extent of Interest in the Elements), or any element or compound when the application is directly associated with nuclear technology.

Isotopic Procedures

Under all conditions other than applications in geologic age determinations

Radiometric Procedures

Under all conditions other than routine tracer studies

Activation Procedures

1.02 Inorganic, Organic, and Physical Chemistry

Chemical properties of actinides, of actual or simulated fission products, or of any element, compound, or mixture when the application is directly associated with nuclear technology

Isotope effects on chemical properties and reactions

Physical chemistry and crystal structure of compounds and nonmetallic elements studied for use in connection with actual or simulated radiation environments. Structural studies in which radioisotopes are used as tools are excluded

1.03 Radiation and Nuclear Chemistry

Radiation effects on compounds and nonmetals
Radiation processes such as radioinduced polymerization or radiation catalysis
Radiolysis
Radioisotope production
See also Separation Processes and ENGINEERING—Isotope Technology
Recoil reaction mechanisms

1.04 Radiochemistry

Radiochemistry under any condition other than the preparation of labeled compounds

1.05 Separation Processes

Fuel processing and reprocessing, both radioisotope and reactor, under any condition
See also Radiochemistry

Chemical separation of isotopes other than analytical applications
See also Analytical Chemistry and ENGINEERING—Isotope Technology
Ore processing for thorium or uranium recovery
Waste processing for concentration, decontamination, or fission product recovery

2.0 EARTH SCIENCES

2.01 Geology and Hydrology

Movement and level of radioactive materials (fallout, natural radioactivity, or radioactive waste) in the earth, rivers, lakes, and streams

Radiometric techniques such as age estimations and well logging when the equipment and/or method is of primary concern.
See also INSTRUMENTATION—Radiometric Instruments

Geological investigations pertinent to underground nuclear explosion technology nuclear facilities, and radioactive waste disposal or storage

2.02 Meteorology

Fallout transport and deposition
Radioactive aerosol and gas movement and dispersal
Radioactivity levels in the atmosphere
Surveys for nuclear facilities and nuclear explosion test sites

2.03 Mineralogy and Exploration

Identification, description, and estimated reserves of thorium and uranium minerals

2.04 Oceanography

Disposal of radioactive material in oceans and seas
Movement and levels of radioactive material in oceans and seas

2.05 Seismology

Nuclear explosion detection and identification systems
Seismological surveys for nuclear facilities

3.0 ENGINEERING

3.01 Nuclear Explosions

Use of nuclear (or simulated nuclear) explosions for the development of detection systems and techniques

Engineering developments and theoretical analyses associated with peaceful applications of nuclear explosions

3.02 Facilities and Equipment

Engineering studies (including economic) not specifically included in another category on the design, construction, and operation of irradiation facilities, laboratories, pilot plants, and other nuclear facilities and equipment

3.03 Heat Transfer and Fluid Flow

Theoretical or engineering studies of heat transfer and fluid flow applied to nuclear facilities, plants, or laboratories

For electrofluid mechanics and magnetofluid mechanics

See **PHYSICS (GENERAL)—Fluid Physics**

3.04 Isotope Technology

Design, development, fabrication, testing, and evaluation of radioisotopes as sources of heat, electricity or propulsion energy.

Design, development, fabrication, testing, and evaluation of radioisotope (including unseparated fission products) radiation sources

Physical separation of isotopes (centrifugal, electromagnetic, gaseous diffusion, and thermal diffusion)

See also **CHEMISTRY—Separation Processes**

3.05 Materials Testing

Equipment, methods, and techniques for destructive and nondestructive testing applied to nuclear technology

3.06 Protective Structures

Design, construction, and effectiveness of structures for protection against nuclear explosions and fallout

See also **LIFE SCIENCES—Health Physics and Safety**

3.07 Radioactive Material Handling

Equipment, facilities, procedures, accountability, and regulations for handling, shipping, storing, or concentrating radioactive materials

3.08 Vacuum Engineering

Design, construction, and operation of ultrahigh vacuum systems and equipment, i.e., 10^{-9} torr or greater. Does not include vacuum systems and equipment that are more appropriately categorized according to the application; e.g., a vacuum system specifically intended for an accelerator is included under **PHYSICS (HIGH ENERGY)—Particle Accelerators**

4.0 INSTRUMENTATION

4.01 Radiation Detection Instruments

General Detectors and Monitors

Nuclear Spectroscopic Instrumentation

High Energy Physics Instrumentation

4.02 Radiation Dosimeters

Design, testing, and theory

4.03 Radiometric Instruments

Design, testing, and theory of instruments which use radiation sources and detectors as means of measurement

4.04 Miscellaneous Instruments and Components

Design, performance, or testing for direct application in nuclear technology

4.05 Radiation Effects on Instruments and Instrument Components

5.0 LIFE SCIENCES

5.01 Biochemistry, Physiology, and Molecular Biology

Basic Processes

Elucidation by radioisotopes in biological materials at any level of organization if: the technique is new; the tracer has not been used previously in biological materials; new apparatus has been designed; or a new method for introducing the tracer is described (for design, testing, and theory of radiation instruments *see* **INSTRUMENTATION)**

Metabolism, Physiology, and Toxicology

All actinide elements, all fission products and any radioisotope if the radioisotope enters the biological material in elemental form or if an isotope effect is reported or discussed.

Radiation Effects

Effects of ionizing radiations (alpha and beta particles, electrons, protons, neutrons, accelerated ions, gamma and x radiation, charged mesons and ultraviolet light below 2537Å) and ultraviolet light, microwaves, high intensity radiation from lasers and all electromagnetic radiations to the extent that they mimic ionizing radiations on biological materials (enzymes, hormones, nucleic acids, cell nuclei, mitochondria, etc.) if a molecule or subcellular organelle is the level of interaction

Immunology

Reactions or responses of nonirradiated hosts to challenge by irradiated materials and reactions of irradiated hosts to challenge by nonirradiated materials (host includes organizational levels from the molecule to the entire organism)

For studies at the cellular level of organization *see* **Genetics and Cytogenetics; Radiation Effects on Animals; Radiation Effects on Plants; and Radiation Effects on Microorganisms**

5.02 Ecology

Movement and fate of radioisotopes, actinide elements, or fission products in animal and plant communities or ecosystems

Effects of ionizing radiations on plant and animal communities and on ecosystems

New techniques for radiologic study of ecosystems

Surveys for nuclear facilities and nuclear explosion test sites

5.03 Genetics and Cytogenetics

Radiation effects on hereditary characteristics and processes at all levels of organization (biochemical through organism) including radioinduced mutations and chromosome aberrations, and characteristics of radioinduced mutants (for somatic effects *see* **Radiation Effects on Plants** and **Radiation Effects on Animals**)

5.04 Health Physics and Safety

Radioactive Contamination and Decontamination

Internal and external
See also **ECOLOGY**

Dosimetry and Monitoring

Measurement, calculation, or estimation of dose from radiation sources (internal and external) to which biological materials are exposed or may be exposed
See also **INSTRUMENTATION—Radiation Detection Instruments**

Radiation Protection

Application and effectiveness of radiation protection by physical agents such as clothing, ointments, etc., other than bulk shielding
See also **ENGINEERING—Protective Structures**

Safety Procedures

Civil Defense

All phases of civil defense planning related to human engineering, including studies of survival in real or simulated post-attack environment

Legal Aspects

Legal aspects, excluding litigation, or activities of agencies and committees (at any level) in the protection of persons or groups of persons against real or anticipated radiation hazards

5.05 Medicine

Protective Substances

Evaluation of substances for protection against, enhancement of, or amelioration of radiation effects (includes animal research)

Radiation Sickness and Injuries

Treatment of radiation sickness and injuries in irradiated animals and man

Radiodiagnosis

New preparations or new or novel techniques

Radiotherapy

New preparations or new or novel techniques

Blast and Thermal Effects

Blast, thermal, and other effects of real or simulated nuclear explosions (includes studies of atomic bomb survivors)

5.06 Radiation Effects on Animals

Invertebrates

Effects (somatic or behavioral) of ionizing radiations, neutrons, accelerated particles, microwaves, ultraviolet light, or high intensity radiation from lasers

Vertebrates

Effects (somatic or behavioral) of ionizing radiations, neutrons, accelerated particles, microwaves, ultraviolet light, or high intensity radiation from lasers

Man

Effects (somatic or behavioral) of ionizing radiations, neutrons, accelerated particles, microwaves, ultraviolet light, or high intensity radiation from lasers

For effects of radiation on immune reactions and genetics, *see* **Biochemistry, Physiology,** and **Molecular Biology** and also **Genetics and Cytogenetics**

5.07 Radiation Effects on Plants

Effects (somatic or behavioral) of ionizing radiations, ultraviolet light, microwaves, or high intensity radiation from lasers on plants

For effects of radiation at the molecular and subcellular levels, *see* **Biochemistry, Physiology,** and **Molecular Biology**

For genetic effects of radiation, *see* **Genetics and Cytogenetics**

5.08 Radiation Effects on Microorganisms

Effects (somatic or behavioral) of ionizing radiations, neutrons, accelerated particles, ultraviolet light, microwaves, or high intensity radiation from lasers on bacteria, bacteriophages, rickettsia, and viruses

For effects of radiation on genetics of microorganisms, *see* **Genetics and Cytogenetics**

5.09 Radiosterilization and Radiopreservation

Use of ionizing radiations on food, pests, and materials such as medical or surgical supplies, vaccines, etc.

For irradiation facilities *see also* **ENGINEERING—Facilities and Equipment**

6.0 METALS, CERAMICS, AND OTHER MATERIALS

For interest in specific elements see Part 2: **Extent of Interest in the Elements**

6.01 Metals and Alloys

Corrosion and Erosion

Involving any metal or alloy under actual or simulated reactor, separation process, or waste disposal conditions

Preparation and Fabrication

For proposed or actual application in nuclear technology

Properties Evaluations

Involving application in accelerator, reactor, or other nuclear technology

Structure and Phase Studies

Metallurgical evaluations associated with nuclear-technology applications

Radiation Effects

6.02 Ceramics, Cermets, and Refractories

Corrosion and Erosion

Involving any ceramic or cermet under actual or simulated reactor, separation process, or waste disposal conditions

Preparation and Fabrication

Involving proposed or actual application in nuclear technology

Properties Evaluations

Involving application in accelerator, reactor, or other nuclear technology

Structure and Phase Studies

Evaluations associated with nuclear-technology applications

Radiation Effects

6.03 Plastics and Other Materials

Corrosion and erosion under actual or simulated reactor, separation process, or waste disposal conditions

Preparation and fabrication for proposed or actual application in nuclear technology

Properties evaluations involving applications in accelerator, reactor, or other nuclear technology

Structure and phase studies associated with evaluations for nuclear-technology applications

Radiation effects

7.0 PHYSICS (GENERAL)

7.01 Astrophysics and Cosmology

Cosmic-ray Exposure Ages

Includes elemental abundance from studies of meteorites, chondrites, etc.

Stars

Composition, evolution, physical conditions, and nucleogenesis

Quasi-Stellar, Radio, and X-Ray Sources

Quasi-stellar sources, blue stellar objects, radiogalaxies, and Seyfert galaxies (theory and detailed studies only, not reports on the location of the objects)

Solar phenomena

Sunspots, prominences, disturbances, solar wind, solar flares, radio bursts, and magnetic field effects; origin of the solar system; and structure and spectra of the sun

Galaxies

Structure, interstellar matter, x-ray sources, H II regions, etc., only as related to radiations, nuclear phenomena, and plasma physics, not celestial mechanics

Cosmology

Structure and evolution of the Universe in the large

Planetary phenomena

Radiation belts (other than van Allen, for which *see* **Geophysics**), interplanetary magnetic fields, and radioemissions only

7.02 Atomic and Molecular Physics

Atomic, Electron, Ion, and Molecular Beams and Their Reactions

Reactions with materials

Atomic and Molecular Properties

Of hydrogen, helium, the actinides, and the lanthanides

Positronium, Muonium, and Mesic Atoms and Molecules

Does not include positron annihilation when used strictly for structural studies

Collision Phenomena

Charge-exchange, excitation, or dissociation phenomena involving electrons, ions, atoms, or molecules

Atomic Theory

For general application; not when exclusively applied to or developed for a specific element

7.03 Cosmic Radiation

All scientific and technical aspects except interactions with the earth's magnetic field, for which *see* **Geophysics**, and biological effects, for which *see* **LIFE SCIENCES**

7.04 Direct Energy Conversion

Magnetofluidmechanic, plasma, and thermionic devices and applications of thermoelectric devices to reactor or other nuclear facilities, and nuclear phenomena or techniques

7.05 Fluid Physics

Electrofluidmechanics
Magnetofluidmechanics

7.06 Geophysics (Upper Atmosphere)

Auroral or ionospheric phenomena only when particle kinetics are discussed

Nuclear detonations and their effects

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Particle kinetics and geomagnetic trapping in van Allen radiation belts.

Particle phenomena resulting from solar-wind or cosmic ray interactions with the earth's magnetic field

7.07 Low-Temperature Physics

Superconductivity and superfluidity

Other cryogenic studies and equipment if nuclear phenomena or techniques are involved

7.08 Plasma and Thermonuclear Physics

(Does not include antenna studies)

Confinement and Heating of Plasma

Diagnostics of Plasma

Kinetics (General)

Kinetics (Experimental)

Kinetics (Theoretical)

Production

Stability

Thermonuclear Processes

Wave Phenomena

7.09 Shielding

Physics of shielding against ionizing radiation, neutrons, and accelerated particles. For applied shielding see sections covering the application; for shield fabrication *see* **Metals, Ceramics, and Other Materials**

7.10 Solid-State Physics

Radiation Effects

On crystallographic or electronic properties of solids

Physical Properties

Of actinides, lanthanides, and other elements of special metallurgical interest in nuclear technology

Moessbauer Effects and Nuclear Magnetic Resonance

In actinides, lanthanides, or other elements of special metallurgical interest in nuclear technology or if a contribution is made to the technique (if nuclear properties are determined, *see* **PHYSICS (NUCLEAR)**)

Theory

7.11 Theoretical Physics

General quantum theory

See also **PHYSICS (HIGH-ENERGY)—Field Theories**

Mathematical physics directly related to nuclear science and technology

8.0 PHYSICS (HIGH ENERGY)

8.01 Particle Interactions and Properties (Experimental)

Includes all experimental studies on the electromagnetic, weak, and strong interactions and properties of particles and radiation quanta and experimental information on hyperfragments (hypernuclei) and particle or radiation quanta reactions with nuclei above the pion production threshold (~400 MeV) under the following subcategories:

Electromagnetic

Weak

Strong (Baryon-Induced)

Strong (Meson-Induced)

8.02 Particle Interactions and Properties (Theoretical)

Includes all theoretical studies on the electromagnetic, weak, and strong interactions and properties of particles and radiation quanta and theoretical information on hyperfragments (hypernuclei) and particle or radiation quanta reactions with nuclei above the pion production threshold (~400 MeV) under the following subcategories:

General

Electromagnetic

Weak

Strong (General)

Strong (Baryon No. = 0)

Strong (Baryon No. = 1)

Strong (Baryon No. ⩾2)

8.03 Particle Invariance Principles and Symmetries

Includes information on the space-time symmetries and internal symmetries of particles and the applications of these symmetries to the electromagnetic, weak, and strong interactions under the following subcategories:

General

Applications to Electromagnetic and Weak Interactions

Applications to Strong Interactions

8.04 Field Theories

Includes all information on quantum field theories, quantum electrodynamics, relativistic quantum mechanics and special relativity theory, and gravitation and general relativity theory under the following subcategories:

General

Quantum Field Theory and Relativistic Mechanics

Gravitation and General Relativity Theory

XUM

8.05 Scattering Theory

Includes general scattering theory only. Information on the application of scattering theory to specific interactions of particles or types of particles is found under other subcategories according to type of interaction (i.e., electromagnetic, weak, or strong)

8.06 Particle Accelerators

Design, development, and operation, auxiliaries and components, ion sources, injection and extraction systems, ion optics and field calculations, storage rings, and experimental facilities (including radiation targets)

9.0 PHYSICS (NUCLEAR)

9.01 Neutron Interactions with Matter

Experimental and theoretical studies of neutron absorption, scattering, thermalization, transport, etc., in macroscopic systems, including solution of the neutron transport equation and theoretical neutron transport in matter in general geometric configurations

Production and calibration of neutron sources

9.02 Nuclear Properties and Reactions, $A \leq 5$, $6 \leq A \leq 19$, $20 \leq A \leq 89$, $A \geq 90$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission

Model calculations for specific nuclei

9.03 Nuclear Theory

Nuclear structure, nuclear matter, nuclear reactions and scattering, nuclear moments and spin, radioactive decay, spontaneous and induced fission, and nuclear models

10.0 REACTOR TECHNOLOGY

10.01 Commercial Power Reactors

Kinetics and dynamics, control systems, shielding, cooling systems, fuels, auxiliary and emergency systems, operation and economics, safety and siting, and steam and power conversion systems

10.02 Power Reactor Development

Kinetics and Dynamics

Control Systems

Shielding

Cooling Systems

Fuels

Auxiliary and Emergency Systems

Operation and Economics

Safety and Siting

Power Conversion Systems

10.03 Research and Test Reactors

Kinetics and dynamics, control systems, shielding, cooling systems, fuels, auxiliary and emergency systems, operation, safety and siting, and test facilities

10.04 Rocket and Space Reactors

Kinetics and dynamics, control systems, shielding, cooling systems, fuels, auxiliary and emergency systems, operation, safety, and power conversion systems

10.05 Process Heat and Desalination Reactors

Kinetics and dynamics, control systems, shielding, cooling systems, fuels, auxiliary and emergency systems, operation and economics, safety and siting, and power conversion systems

10.06 Marine and Portable Power Reactors

Kinetics and dynamics, control systems, shielding, cooling systems, fuels, auxiliary and emergency systems, operation and economics, safety, and power conversion systems

10.07 Production Reactors

Shielding, operation and performance, and safety and radiation hazards

10.08 Reactor Theory

Kinetics

Dynamics

Experimental Applications

10.09 Reactor Components, Fuels, and Accessories

(Where no type is specified)

11.0 GENERAL

Publicly available annual administrative and research and development reports from the United States Atomic Energy Commission and the national nuclear energy organizations of the United Kingdom, Canada, Sweden, Denmark, Japan, Australia, France, and Norway which are outside the subject scope of other categories.

XUM

Part 2

EXTENT OF INTEREST IN THE ELEMENTS

ACTINIUM

All scientific and technical aspects

ALUMINUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

AMERICIUM

All scientific and technical aspects

ANTIMONY

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

ARGON

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

ARSENIC

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

ASTATINE

All scientific and technical aspects

BARIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

BERKELIUM

All scientific and technical aspects

BERYLLIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

BISMUTH

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of liquid bismuth

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

BORON

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steel containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state physics

BROMINE

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CADMIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steel containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state physics

CALCIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CALIFORNIUM

All scientific and technical aspects

CARBON

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, it compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Properties and fabrication of nuclear-grade graphite and graphite fuel materials
Radiation effects
Radiochemistry

CERIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Atomic properties
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state physics

CESIUM

Analysis, determination, and separation
Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CHLORINE

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment
Isotopes (excluding routine application as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

CHROMIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment
Isotopes (excluding routine applications as tracers or radiation sources)
Metabolism, tissue distribution, and toxicology of radioisotopes
Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

COBALT

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element,

XUM

its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

COPPER

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

CURIUM

All scientific and technical aspects

DYSPROSIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application) compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

EINSTEINIUM

All scientific and technical aspects

ERBIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

EUROPIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

FERMIUM

All scientific and technical aspects

FLUORINE

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

FRANCIUM

All scientific and technical aspects

GADOLINIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

GALLIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

GERMANIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

GOLD

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

HAFNIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

HELIUM

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Superfluidity

HOLMIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

HYDROGEN

Applications of the element or its compounds and systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of deuterium and tritium

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

INDIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

IODINE

Analysis, determination, and separation

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

IRIDIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

XUM

IRON

Applications of the element and its alloys or systems, including steel and stainless steel, in nuclear technology or the behavior of the element, its alloys, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

KRYPTON

Analysis, determination, and separation

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

LANTHANUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

LAWRENCIUM (103)

All scientific and technical information

LEAD

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

LITHIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

LUTETIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

MAGNESIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

MANGANESE

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

MENDELEVIUM

All scientific and technical aspects

MERCURY

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

MOLYBDENUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

NEODYMIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys, compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

NEON

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

NEPTUNIUM

All scientific and technical aspects

NICKEL

Applications of the element or its alloys, compounds, or systems, in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

NIOBIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

NITROGEN

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

NOBELIUM

All scientific and technical aspects

OSMIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

OXYGEN

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

PALLADIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

XUM

PHOSPHORUS

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

PLATINUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

PLUTONIUM

All scientific and technical aspects

POLONIUM

All scientific and technical aspects

POTASSIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

PRASEODYMIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

PROMETHIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys, compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

PROTACTINIUM

All scientific and technical aspects

RADIUM

All scientific and technical aspects

RADON

All scientific and technical aspects

RHENIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

RHODIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

RUBIDIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

RUTHENIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element,

its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

SAMARIUM

Analysis, determination, and separation

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Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

SCANDIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state physics

SELENIUM

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

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Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

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Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

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Nuclear properties and nuclear reactions

Radiation effects

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Isotopes (excluding routine applications as tracers or radiation sources)

XUM

Metabolism, tissue distribution, and toxicology of radioisotopes

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Nuclear properties and nuclear reactions

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Solid-state physics

TECHNETIUM

All scientific and technical aspects

TELLURIUM

Analysis, determination, and separation

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Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

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TERBIUM

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THORIUM

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THULIUM

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Metabolism, tissue distribution, and toxicology of radioisotopes

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TIN

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Nuclear properties and nuclear reactions

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Radiochemistry

TRANSLAWRENCIUM ELEMENTS

All scientific and technical aspects

TUNGSTEN

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Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

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URANIUM

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YTTRIUM

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Journals from which articles have been abstracted and indexed in *NSA* are listed here alphabetically by title abbreviation. The list will be supplemented in issue numbers 7, 13, and 19 of this volume.

The foreign language journals in this list available in English language translation are indicated and the title of the English language journal is included.

The title abbreviations are based on the National Clearinghouse for Periodical Title Word Abbreviations, *Word Abbreviation List* published by the Standards Committee Z-39 of the American National Standards Institute.

TID-4579 (4th Ed.) *Serial Titles Cited in Nuclear Science Abstracts* lists the titles and abbreviations of the journals regularly scanned for *NSA* as well as those from which an occasional item is taken. This publication is available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22151, for $3.00 for full size or reproduction copy and $0.65 for microfiche copy.

A

Abh. Akad. Wiss. Goettingen, Math.-Physik. Kl.
Abhandlungen der Akademie der Wissenschaften in Goettingen, Mathematisch-Physikalische Klasse (West Germany)

Abh. Deut. Akad. Wiss. Berlin, Kl. Med.
Abhandlungen der Deutschen Akademie der Wissenschaften zu Berlin, Klasse fuer Medizin (East Germany)

Abrasive Eng.
Abrasive Engineering (U.S.)

Acad. Roy. Belg., Cl. Sci., Mem., Collect. 8
Academie Royale de Belgique, Classe des Sciences, Memoires, Collection in 8 (Formerly carried as Memoires, Academie Royale des Belgique, Classe des Sciences, Collection in 8 (Belgium)

Accounts Chem. Res.
Accounts of Chemical Research (U.S.)

ACEC (Ateliers Constr. Elec. Charleroi) Rev.
ACEC (Ateliers de Constructions Electriques de Charleroi) Reviews (Belgium)

Acier
Acier-Stahl-Steel (Belgium)

Acta Acad. Abo., Ser. B
Acta Academae Aboensis, Series B, Mathematica et Physica (Finland)

Acta Agron. (Budapest)
Acta Agronomica (Budapest) (Hungary)

Acta Biochim. Biophys. (Budapest)
Acta Biochimica et Biophysica, Academiae Scientiarum Hungaricae (Budapest) (Hungary)

Acta Biol. Acad. Sci. Hung.
Acta Biologica Academiae Scientiarum Hungaricae (Hungary)

Acta Biol. Exp., Pol. Acad. Sci.
Acta Biologiae Experimentalis, Polish Academy of Sciences (Poland)

Acta Biol. Med. Ger.
Acta Biologica et Medica Germanica (East Germany)

Acta Bot. Neer.
Acta Botanica Neerlandica (Netherlands)
Supersedes Nederlandsch Kruidkundig Archief and Recueil des Travaux Botaniques Nederlandais

Acta Chem. Fenn.
Acta Chemica Fennica (Finland)

Acta Chem. Scand.
Acta Chemica Scandinavica (Denmark)

Acta Chim. Acad. Sci. Hung.
Acta Chimica Academiae Scientiarum Hungaricae (Hungary)

Acta Chir. Acad. Sci. Hung.
Acta Chirurgica Academiae Scientiarum Hungaricae (Hungary)

Acta Chir. Belg., Suppl.
Acta Chirurgica Belgica, Supplement (Belgium)

Acta Chir. Orthopaed. Traumatol. Cech.
Acta Chirurgiae Orthopaedicae et Traumatologiae Cechoslovaca (Czechoslovakia)

Acta Chir. Plast.
Acta Chirurgiae Plasticae (Czechoslovakia)

Acta Chir. Scand.
Acta Chirurgica Scandinavica (Sweden)

Acta Cient.
Acta Cientifica (Argentina)

Acta Cient. Venez.
Acta Cientifica Venezolana (Venezuela)

Acta Crystallogr.
Acta Crystallographica (Denmark)
Divided into Sections A and B

Acta Crystallogr., Sect. A
Acta Crystallographica, Section A. Crystal Physics, Diffraction, Theoretical and General Crystallography (Continues in Part Acta Crystallographica) (Denmark)

Acta Crystallogr., Sect. B
Acta Crystallographica, Section B. Structural Crystallography and Crystal Chemistry (Continues in Part Acta Crystallographica) (Denmark)

Acta Cytol.
Acta Cytologica (U.S.)

Acta Dermato-Venereol.
Acta Dermato-Venereologica (Sweden)

Acta Endocrinol.
Acta Endocrinologica (Denmark)

Acta Endocrinol., Suppl.
Acta Endocrinologica, Supplementum (Denmark)

Acta Genet. Med. Gemellol.
Acta Geneticae Medicae et Gemellologiae (Italy)

Acta Geod., Geophys. Montanistica
Acta Geodaetica, Geophysica et Montanistica (Hungary)

Acta Geol. Geogr. Univ. Comenianae, Geol.
Acta Geologica et Geographica Universitatis Comenianae, Geologica (Czechoslovakia)

Acta Geophys. Pol.
Acta Geophysica Polonica (Poland)

Acta Haematol.
Acta Haematologica. International Journal of Hematology (Switzerland)

Acta Histochem.
Acta Histochemica (East Germany)

Acta Histochem., Suppl.
Acta Histochemica, Supplementband (East Germany)

Acta Iber. Radiol.-Cancerol.
Acta Iberica Radiologica-Cancerologica (Spain)

Acta Isotop.
Acta Isotopica (Italy)

Acta Med. Acad. Sci. Hung.
Acta Medica Academiae Scientiarum Hungaricae (Hungary)

Acta Med. Biól. (Niigata)
Acta Medica et Biologica (Niigata) (Japan)

Acta Med. Okayama
Acta Medicinae Okayama (Japan)

Acta Med. Scand.
Acta Medica Scandinavica (Sweden)

Acta Met.
Acta Metallurgica (U.S.)

Acta Microbiol. Pol.
Acta Microbiologica Polonica (Poland)
Divided into Series A and B

Acta Microbiol. Pol., Ser. A
Acta Microbiologica Polonica, Series A. Microbiologia Generalis (Poland)

Acta Morphol. Acad. Sci. Hung.
Acta Morphologica Academiae Scientiarum Hungaricae (Hungary)

Acta Neurochir.
Acta Neurochirurgica (Austria)

Acta Neurochir., Suppl.
Acta Neurochirurgica, Supplementum (Austria)

Acta Neurol. Psychiat. Belg.
Acta Neurologia et Psychiatrica Belgica (Belgium)

Acta Neurol. Scand.
Acta Neurologica Scandinavica. (Denmark)

Acta Neurol. Scand., Suppl.
Acta Neurologica Scandinavica, Supplementum. (Denmark)

Acta Neuropathol.
Acta Neuropathologica (Germany)

Acta Neuroveg.
Acta Neurovegetativa (Austria)

Acta Obstet. Ginecol. Hisp.-Lusit.
Acta Obstetrica et Ginecologica Hispano-Lusitana (Spain)

Acta Obstet. Gynaecol. Jap.
Acta Obstetrica et Gynaecologica Japonica (Formerly Journal of the Japanese Obstetrical and Gynecological Society) (Japan)

Acta Obstet. Gynecol. Scand.
Acta Obstetricia et Gynecologica Scandinavica (Sweden)

Acta Obstet. Gynecol. Scand., Suppl.
Acta Obstetricia et Gynecologica Scandinavica, Supplement (Sweden)

Acta Odontol. Scand.
Acta Odontologica Scandinavica (Sweden)

Acta Oncol.
Acta Oncologica (Spain)

Acta Ophthalmol.
Acta Ophthalmologica (Denmark)

Acta Orthop. Scand.
Acta Orthopaedica Scandinavica (Denmark)

Acta Oto-Laryngol.
Acta Oto-Laryngologica (Sweden)

Acta Paediat. Acad. Sci. Hung.
Acta Paediatrica Academiae Scientiarum Hungaricae (Hungary)

Acta Pathol. Jap.
Acta Pathologica Japonica (Japan)

Acta Pathol. Microbiol. Scand.
Acta Pathologica et Microbiologica Scandinavica (Denmark)
Divided into Sections A and B

Acta Pharm. Hung.
Acta Pharmaceutica Hungarica (Hungary)

Acta Pharm. Jugoslav.
Acta Pharmaceutica Jugoslavica (Yugoslavia)

Acta Pharm. Suec.
Acta Pharmaceutica Suecica (Sweden)

Acta Pharm. Toxicol.
Acta Pharmacologica et Toxicologica. (Denmark)

Acta Pharm. Toxicol., Suppl.
Acta Pharmacologica et Toxicologica, Supplementum (Denmark)

Acta Phys. Acad. Sci. Hung.
Acta Physica Academiae Scientiarum Hungaricae (Hungary)

Acta Phys. Austr.
Acta Physica Austriaca (Austria)

Acta Phys. Austr., Suppl.
Acta Physica Austriaca, Supplementum (Austria)

Acta Phys. Chem.
Acta Physica et Chemica (Hungary)

Acta Physiol. Acad. Sci. Hung.
Acta Physiologica Academiae Scientiarum Hungaricae (Hungary)

Acta Physiol. Pol.
Acta Physiologica Polonica (Poland)

Acta Physiol. Scand.
Acta Physiologica Scandinavica (Sweden)

Acta Physiol. Scand., Suppl.
Acta Physiologica Scandinavica, Supplementum (Sweden)

Acta Phys. Pol.
Acta Physica Polonica (Poland)
Divided into Series A and B, Beginning January 1970

Acta Phys. Pol., A
Acta Physica Polonica, A (Poland)

Acta Phys. Pol., B
Acta Physica Polonica, B (Poland)

Acta Phytopathol. (Budapest)
Acta Phytopathologica Academiae Scientiarum Hungaricae (Budapest) (Hungary)

Acta Pol. Pharm.
Acta Poloniae Pharmaceutica (Poland)

Acta Polytech. Scand., Civil Eng. Ser.
Acta Polytechnica Scandinavica, Civil Engineering Series (Formerly Acta Polytechnica Scandinavica, Civil Engineering and Building Construction Series)

Acta Polytech. Scand., Math. Comput. Mach. Ser.
Acta Polytechnica Scandinavica, Mathematics and Computing Machinery Series (Sweden)

Acta Polytech. Scand., Mech. Eng. Ser.
Acta Polytechnica Scandinavica, Mechanical Engineering Serie (Sweden)

Acta Protozool.
Acta Protozoologica (Poland)

Acta Radiol., Diagn.
Acta Radiologica, Diagnosis. (Sweden)

Acta Radiol., Suppl.
Acta Radiologica, Supplementum (Sweden)

Acta Radiol., Ther., Phys., Biol.
Acta Radiologica, Therapy, Physics, Biology (Sweden)

Acta Soc. Bot. Pol.
Acta Societatis Botanicorum Poloniae (Poland)

Acta Soc. Med. Upsal.
Acta Societatis Medicorum Upsaliensis (Sweden)

Acta Stomatol. Belg.
Acta Stomatologica Belgica (Belgium)

XUM

Acta Tech. Acad. Sci. Hung.
Acta Technica Academiae Scientiarum Hungaricae (Hungary)

Acta Tech. CSAV
Acta Technica CSAV (Ceskoslovenska Akademia Ved) (Czechoslovakia)

Acta Tuberc. Pneumol. Belg.
Acta Tuberculosea et Pneumologica Belgica (Belgium)

Acta Univ. Carolinae, Med., Monogr.
Acta Universitatis Carolinae, Medica, Monographia (Czechoslovakia)

Acta Univ. Palacki. Olomuc., Fac. Med.
Acta Universitatis Palackinae Olomucensis, Facultatis Medicinae (Czechoslovakia)

Acta Urol. Belg.
Acta Urologica Belgica (Belgium)

Acta Vet. (Belgrade)
Acta Veterinaria (Beigrade) (Yugoslavia)

Acta Vet. Scand.
Acta Veterinaria Scandinavica (Denmark)

Acta Virol. (Prague) Engl. Ed.
Acta Virologica (Prague). An International Journal. English Edition (Czechoslovakia)

Acta Vitaminol. Enzymol.
Acta Vitaminologica et Enzymologica (Formerly Acta Vitaminologica) (Italy)

Actinides Rev.
Actinides Reviews (Netherlands)

Acustica
Acustica. International Journal for Acoustics (West Germany)

ADM (Asoc. Dent. Mex.) Rev.
ADM (Asociacion Dental Mexicana) Revista (Mexico)

Advan. Activ. Anal.
Advances in Activation Analysis (England)

Advan. Biol. Med. Phys.
Advances in Biological and Medical Physics (U.S.)

Advan. Chem. Phys.
Advances in Chemical Physics (England)

Advan. Chem. Ser.
Advances in Chemistry Series (U.S.)

Advan. Cryog. Eng.
Advances in Cryogenic Engineering (U.S.)

Advan. Electron. Electron Phys.
Advances in Electronics and Electron Physics (U.S.)

Advan. Food Res.
Advances in Food Research (U.S.)

Advan. Geophys.
Advances in Geophysics (U.S.)

Advan. High Pressure Res.
Advances in High Pressure Research (England)

Advan. Inorg. Chem. Radiochem.
Advances in Inorganic Chemistry and Radiochemistry (U.S.-England)

Advan. Nucl. Phys.
Advances in Nuclear Physics (U. S.)

Advan. Obstet. Gynecol. (Baltimore)
Advances in Obstetrics and Gynecology (Baltimore) (U.S.)

Advan. Particle Phys.
Advances in Particle Physics (U.S.)

Advan. Phys.
Advances in Physics (England)

Advan. Plasma Phys.
Advances in Plasma Physics (U.S.)

Advan. Radiat. Chem.
Advances in Radiation Chemistry (U. S.)

Advan. Sci.
Advancement of Science, The (England)

Advan. Theor. Phys.
Advances in Theoretical Physics (U.S.)

Advan. X-Ray Anal.
Advances in X-Ray Analysis (U.S.)

Aeronaut. Astronaut. (Paris)
Aeronautique et l'Astronautique (Formerly Technique et Science Aeronautiques et Spatiales) (France)

Aeronaut. Quart.
Aeronautical Quarterly (England)

Aerosp. Med.
Aerospace Medicine (Formerly The Journal of Aviation Medicine) (U. S.)

Aerztl. Forsch.
Aerztliche Forschung (West Germany)

Agrarpolit. Rev.
Agrarpolitische Revue (Switzerland)

Agr. Biol. Chem. (Tokyo)
Agricultural and Biological Chemistry (Tokyo) (Japan)

Agr. Chem.
Agricultural Chemicals (U.S.)

Agressologie
Agressologie. Revue Internationale de Physico-Biologie et de Pharmacologie Appliquees aux Effects de l'Agression (France)

Agri Hort. Genet.
Agri Hortique Genetika (Sweden)

Agr. Marketing (Wash.)
Agricultural Marketing (Washington) (U.S.)

Agrokem. Talajtan
Agrokemia es Talajtan (Hungary)

Agron. J.
Agronomy Journal (U.S.)

AIAA (Amer. Inst. Aeronaut. Astronaut.) J.
AIAA (American Institute of Aeronautics and Astronautics) Journal (Combining the ARS Journal and the Journal of Aerospace Science) (U.S.)

AIAA (Amer. Inst. Aeronaut. Astronaut.) Stud. J.
AIAA (American Institute of Aeronautics and Astronautics) Student Journal (U.S.)

Air Cosmos
Air et Cosmos (France)

Akita-Kenritsu Chuo Byoin Igaku Zasshi
Akita-Kenritsu Chuo Byoin Igaku Zasshi (Akita Central Hospital Medical Journal) (Japan)

Akush. Ginekol.
Akusherstvo i Ginekologiya (U.S.S.R.)

Ala. J. Med. Sci.
Alabama Journal of Medical Sciences, The (U.S.)

Aliment. Vie
Alimentation et la Vie (Formerly Bulletin de la Societe Scientifique d'Hygiene Alimentaire et d'Alimentation Rationnelle) (France)

Allergie Asthma
Allergie und Asthma (East Germany)

Allis-Chalmers Eng. Rev.
Allis-Chalmers Engineering Review (U.S.)

Alta Freq.
Alta Frequenza. Rivista di Radiotecnica, Telefonia e Acustica Applicata (Italy)

Aluminium
Aluminium (West Germany)

Alyum. Splavy, Sb. Statei
Alyuminievye Splavy, Sbornik Statei (U.S.S.R.)

Amer. Ass. Advan. Sci., Symp.
American Association for the Advancement of Science, Symposium (U.S.)

Amer. Bee J.
American Bee Journal (U.S.)

Amer. Ceram. Soc. Bull.
American Ceramic Society Bulletin, The (U.S.)

Amer. Heart J.
American Heart Journal (U.S.)

Amer. Ind. Hyg. Ass. J.
American Industrial Hygiene Association Journal (U.S.)

Amer. J. Anat.
American Journal of Anatomy, The (U.S.)

Amer. J. Bot.
American Journal of Botany (U.S.)

Amer. J. Cardiol.
American Journal of Cardiology, The (U.S.)

Amer. J. Clin. Nutr.
American Journal of Clinical Nutrition, The (U.S.)

Amer. J. Clin. Pathol.
American Journal of Clinical Pathology (U.S.)

Amer. J. Dis. Child.
American Journal of Diseases of Children (U.S.)

Amer. J. Epidemiol.
American Journal of Epidemiology (U.S.)

Amer. J. Gastroenterol.
American Journal of Gastroenterology, The (U.S.)

Amer. J. Hosp. Pharm.
American Journal of Hospital Pharmacy (U.S.)

Amer. J. Med.
American Journal of Medicine, The (U.S.)

Amer. J. Med. Sci.
American Journal of the Medical Sciences, The (U.S.)

Amer. J. Obstet. Gynecol.
American Journal of Obstetrics and Gynecology (U.S.)

Amer. J. Ophthalmol.
American Journal of Ophthalmology (U.S.)

Amer. J. Optom.
American Journal of Optometry (U.S.)

Amer. J. Orthop.
American Journal of Orthopedics (U.S.)

Amer. J. Pathol.
American Journal of Pathology, The (U.S.)

Amer. J. Phys.
American Journal of Physics (U.S.)

Amer. J. Physiol.
American Journal of Physiology, The (U.S.)

Amer. J. Phys. Med.
American Journal of Physical Medicine (U. S.)

Amer. J. Public Health
American Journal of Public Health and the Nations Health (U.S.)

Amer. J. Roentgenol., Radium Ther. Nucl. Med.
American Journal of Roentgenology, Radium Therapy and Nuclear Medicine, The (U.S.)

Amer. J. Surg.
American Journal of Surgery, The (U.S.)

Amer. J. Trop. Med. Hyg.
American Journal of Tropical Medicine and Hygiene (U.S.)

Amer. J. Vet. Res.
American Journal of Veterinary Research (U.S.)

Amer. Mach./Metalwork. Mfg.
American Machinist/Metalworking Manufacturing (U.S.)

Amer. Mineral.
American Mineralogist, The (U.S.)

Amer. Natur.
American Naturalist, The (U.S.)

Amer. Rev. Respirat. Dis.
American Review of Respiratory Diseases (U.S.)

Amer. Sch.
American Scholar (U.S.)

Amer. Sci.
American Scientist (U.S.)

Amer. Soc. Test. Mater., Spec. Tech. Publ.
American Society for Testing and Materials, Special Technical Publication (U. S.)

Amer. Surg.
American Surgeon (U.S.)

Aminosan Kyokai Gijutsu Bukai-ho
Aminosan Kyokai Gijutsu Bukai-ho (Japan)

An. Acad. Brasil. Cienc.
Anais da Academia Brasileira de Ciencias (Brazil)

An. Acad. Brasil. Cienc., Supl.
Anais da Academia Brasileira de Ciencias, Suplemento (Brazil)

Anaesthesist
Anaesthesist (West Germany)

Anal. Biochem.
Analytical Biochemistry (U.S.)

Anal. Chem.
Analytical Chemistry (U.S.)

Anal. Chim. Acta
Analytica Chimica Acta (Netherlands)

Anal. Instrum.
Analysis Instrumentation (U.S.)

Anal. Lett.
Analytical Letters (U.S.)

Analyst
Analyst, The (England)

Anat. Rec.
Anatomical Record, The (U.S.)

Anesthesiology
Anesthesiology (U.S.)

An. Fis.
Anales de Fisica. Real Sociedad Espanola de Fisica y Quimica (Formerly Anales de la Real Sociedad Espanola de Fisica y Quimica, Serie A. Fisica) (Spain)

Angew. Chem. Int. Ed. Engl.
Angewandte Chemie. International Edition in English (U.S.-West Germany)

Angew. Makromol. Chem.
Angewandte Makromolekulare Chemie (Switzerland)

Angiology
Angiology (U.S.)

Anglo-Ger. Med. Rev.
Anglo-German Medical Review (West Germany)

An. Inst. Cercet. Pentru Cereale Plante Teh. Fundulea
Analele Institutului de Cercetari Pentru Cereale si Plante Tehnice Fundulea (Romania)

An. Inst. Cercet. Pentru Cereale Plante Teh.-Fundulea, Ser. C
Analele Institutului de Cercetari Pentru Cereale si Plante Tehnice-Fundulea, Institutul Central de Cercetari Agricole, Consiliul Superior al Agriculturii, Seria C (Romania)

An. Inst. Invest. Vet. (Madrid)
Anales del Instituto de Investigaciones Veterinarias (Madrid) (Spain)

Ankara Univ. Tip Fak. Mecm.
Ankara Universitesi Tip Fakultesi Mecmuasi (Turkey)

An. Lactol. Quim. Agr. Zaragoza
Anales de Lactologia y Quimica Agricola de Zaragoza (Spain)

Ann. Acad. Sci. Fenn., Ser A II
Annales Academiae Scientiarum Fennicae, Series A II. Chemica (Finland)

Ann. Acad. Sci. Fenn., Ser. A IV
Annales Academiae Scientiarum Fennicae, Series A IV. Biologia (Finland)

Ann. Acad. Sci. Fenn., Ser. A VI
Annales Academiae Scientiarum Fennicae, Series A VI. Physica (Finland)

Ann. Agr. Fenn.
Annales Agriculturae Fenniae (Finland)

XUM

Ann. Agr. Fenn., Ser. Agrogeol., -Chim. -Phys.
Annales Agriculturae Fenniae, Seria Agrogeologia, -Chimica et -Physica (Finland)

Ann. Astrophys.
Annales d'Astrophysique (France)
Superseded by Astronomy and Astrophysics

Ann. Biol. Anim., Biochim., Biophys.
Annales de Biologie Animale, Biochimie, Biophysique (France)

Ann. Biol. Clin. (Paris)
Annales de Biologie Clinique (Paris) (France)

Ann. Bot. (London)
Annals of Botany (London) (England)

Ann. Chim. (Paris)
Annales de Chimie (Paris) (France)

Ann. Chim. (Rome)
Annali di Chimica (Rome) (Italy)

Ann. Chir. Gynaecol. Fenn.
Annales Chirurgiae et Gynaecologiae Fenniae (Finland)

Ann. Chir. Gynaecol. Fenn., Suppl.
Anales Chirurgiae et Gynaecologiae Fenniae, Supplementum (Finland)

Ann. Chir. Plast., Sem. Hop.
Annales de Chirurgie Plastique, Archives de la Ste Francaise Chirurgie Plastique et Reconstructive, la Semaine des Hopitaux (France)

Ann. Dent.
Annals of Dentistry (U.S.)

Ann. Endocrinol. (Paris)
Annales d'Endocrinologie (Paris) (France)

Ann. Entomol. Soc. Amer.
Annals of the Entomological Society of America (U.S.)

Ann. Geofis. (Rome)
Annali di Geofisica (Rome) (Italy)

Ann. Geophys.
Annales de Geophysique (France)

Ann. Histochim.
Annales d'Histochimie (France)

Ann. Hum. Genet.
Annals of Human Genetics (England)

Ann. Inst. Henri Poincare, Sect. A
Annales de l'Institut Henri Poincare, Section A. Physique Theorique (France)

Ann. Inst. Pasteur Lille
Annales de l'Institut Pasteur de Lille (France)

Ann. Inst. Pasteur, Paris
Annales de l'Institut Pasteur, Paris (France)

Ann. Inst. Tech. Batiment Trav. Publics
Annales de l'Institut Technique du Batiment et des Travaux Publics (France)

Ann. Intern. Med.
Annals of Internal Medicine (U.S.)

Ann. IQSY (Int. Years Quiet Sun)
Annals of the IQSY (International Years of the Quiet Sun) (U.S.)

Ann. Ist. Super. Sanita
Annali dell' Istituto Superiore di Sanita (Italy)

Ann. Laringol., Otol., Rinol., Faringol.
Annali di Laringologia, Otologia, Rinologia, Faringologie (Italy)

Ann. Mat. Pura Appl.
Annali di Matematica Pura ed Applicata (Italy)

Ann. Med. Exp. Biol. Fenn. (Helsinki)
Annales Medicinae Experimentalis et Biologiae Fenniae (Helsinki) (Finland)

Ann. Med. Inter. Fenn.
Annales Medicinae Internae Fenniae (Finland)
Superseded by Annals of Clinical Research

Ann. Med.-Psychol.
Annales Medico-Psychologiques (France)

Ann. Mines
Annales des Mines (France)

Ann. Nutr. Aliment.
Annales de la Nutrition et de l' Alimentation (France)

Ann. N.Y. Acad. Sci.
Annals of the New York Academy of Sciences (U.S.)

Ann. Occup. Hyg.
Annals of Occupational Hygiene, The (England)

Ann. Ostet. Ginecol.
Annali di Ostericia e Ginecologia (Italy)

Ann. Otol., Rhinol., Laryngol.
Annals of Otology, Rhinology, and Laryngology (U.S.)

Ann. Ottalmol. Clin. Oculist.
Annali di Ottalmoligia e Clinica Oculistica (Italy)

Annot. Zool. Jap.
Annotationes Zoologicae Japonenses (Japan)

Ann. Paediat. Fenn.
Annales Paediatriae Fenniae (Finland)
Superseded by Annals of Clinical Research

Ann. Paediat. Jap.
Annales Paediatrici Japonici, Kioto Universitatis (Japan)

Ann. Pharm. Fr.
Annales Pharmaceutiques Francaises (France)

Ann. Phys. (Leipzig)
Annalen der Physik (Leipzig) (East Germany)

Ann. Phys. (N.Y.)
Annals of Physics (New York) (U.S.)

Ann. Phys. (Paris)
Annales de Physique (Paris) (France)

Ann. Radioelec.
Annales de Radioelectricite (France)
Superseded by Revue Technique Thomson-CSF

Ann. Radiol.
Annales de Radiologie (France)

Ann. Radiol. Diagn.
Annali di Radiologia Diagnostica (Bologna) (Italy)

Ann. Rheum. Dis.
Annals of the Rheumatic Diseases (England)

Ann. Roy. Coll. Surg. Engl.
Annals of the Royal College of Surgeons of England (England)

Ann. Sanita Pubblica
Annali della Sanita Pubblica (Italy)

Ann. Scu. Norm. Super. Pisa, Sci. Fis. Mat.
Annali della Scuola Normale Superiore di Pisa, Scienze Fisiche e Matematiche (Italy)

Ann. Soc. Sci. Brux. Ser. I
Annales de la Societe Scientifique de Bruxelles. Serie I (Belgium)

Ann. Surg.
Annals of Surgery (U.S.)

Ann. Technol. Agr.
Annales de Technologie Agricole (France)

Ann. Telecommun.
Annales des Telecommunications (France)

Ann. Thorac. Surg.
Annals of Thoracic Surgery (U. S.)

Ann. Trop. Med. Parasitol.
Annals of Tropical Medicine and Parasitology. (England)

Ann. Univ. Sci. Budapest. Rolando Eotvos Nominatae, Sect. Chim.
Annales Universitatis Scientiarum Budapestinensis de Rolando Eotvos Nominatae, Sectio Chimica (Hungary)

Annu. Rep. Inst. Virus Res., Kyoto Univ.
Annual Report of Institute for Virus Research, Kyoto University (Japan)

Annu. Rep. Nat. Inst. Genet. (Engl. Ed.)
Annual Report of the National Institute of Genetics (English Edition) (Japan)

Annu. Rep. Progr. Chem., Sect. B
Annual Reports on the Progress of Chemistry, Section B. Organic Chemistry (England)
Supersedes in part Annual Reports on the Progress of Chemistry (Chemical Society of London)

Annu. Rep. Radiat. Center Osaka Prefect.
Annual Report of the Radiation Center of Osaka Prefecture (Japan)

Annu. Rep. Res. Inst. Environ. Med., Nagoya Univ.
Annual Report of the Research Institute of Environmental Medicine, Nagoya University (Japan)

Annu. Rep. Res. Reactor Inst., Kyoto Univ.
Annual Reports of the Research Reactor Institute, Kyoto University (Japan)

Annu. Rev. Astron. Astrophys.
Annual Review of Astronomy and Astrophysics (U.S.)

Annu. Rev. Biochem.
Annual Review of Biochemistry (U.S.)

Annu. Rev. Entomol.
Annual Review of Entomology. (U.S.)

Annu. Rev. Fluid Mech.
Annual Review of Fluid Mechanics (U. S.)

Annu. Rev. Genet.
Annual Review of Genetics (U.S.)

Annu. Rev. Microbiol.
Annual Review of Microbiology. (U.S.)

Annu. Rev. Nucl. Sci.
Annual Review of Nuclear Science (U.S.)

Annu. Rev. Phys. Chem.
Annual Review of Physical Chemistry (U.S.)

Annu. Rev. Physiol.
Annual Review of Physiology (U. S.)

An. Quim.
Anales de Quimica. Real Sociedad Espanola de Fisica y Quimica (Formerly Anales de la Real Sociedad Espanola de Fisica y Quimica, Serie B. Quimica) (Spain)

An. Real Soc. Espan. Fis. Quim. (Madrid), Ser. A
Anales de la Real Sociedad Espanola de Fisica y Quimica (Madrid) Serie A (Spain)
Superseded by Anales de Fisica

An. Real Soc. Espan. Fis. Quim. (Madrid), Ser. B
Anales de la Real Sociedad Espanola de Fisica y Quimica (Madrid) Serie B (Spain)
Superseded by Anales de Quimica

An. Stiint. Univ. Al. I. Cuza Iasi, Sect. I
Analele Stiintifice ale Universitatii Al. I. Cuza din Iasi, Sectiunea I (Romania)

An. Stiint. Univ. Al. I. Cuza Iasi, Sect. Ib. Fiz.
Analele Stiintifice ale Universitatii Al. I. Cuza din Iasi, Sectiunea Ib. Fizica (Romania)

An. Stiint. Univ. Al. I. Cuza Iasi, Sect. Ic. Chim.
Analele Stiintifice ale Universitatii Al. I. Cuza din Iasi, Sectiunea Ic. Chimie (Romania)

Antarctic J. U. S.
Antarctic Journal of the United States (U.S.)

Antibiot. Chemother.
Antibiotica et Chemotherapia (Switzerland)

Antibiotiki
Antibiotiki (U.S.S.R.)

Antimicrob. Agents Chemother.
Antimicrobial Agents and Chemotherapy (U.S.)

Antonie Van Leeuwenhoek J. Microbiol. Serol.
Antonie Van Leeuwenhoek Journal of Microbiology and Serology (Netherlands)

An. Univ. Timisoara, Ser. Stiinte Mat.-Fiz.
Analele Universitatii Timisoara, Seria Stiinte Matematice-Fizice (Romania)

Anzen Eisei
Anzen Eisei (The Safety and Hygiene) (Japan)

Anzen Kogaku
Anzen Kogaku (Safety Engineering) (Japan)

Aomori Kenritsu Chuo Byoin Ishi
Aomori Kenritsu Chuo Byoin Ishi (Japan)

APL (Appl. Phys. Lab.) Tech. Dig.
APL (Applied Physics Laboratory) Technical Digest (U.S.)

Apl. Mat.
Aplikace Matematiky (Czechoslovakia)

Appl. Econ.
Applied Economics (England)

Appl. Entomol. Zool.
Applied Entomology and Zoology (Japan)

Appl. Microbiol.
Applied Microbiology (U.S.)

Appl. Opt.
Applied Optics (U.S.)

Appl. Phys. Lett.
Applied Physics Letters (U.S.)

Appl. Polym. Symp.
Applied Polymer Symposia (supersedes in part Journal of Applied Polymer Science) (U. S.)

Appl. Sci. Res. (The Hague)
Applied Scientific Research (The Hague) (Netherlands)

Appl. Spectrosc.
Applied Spectroscopy (U.S.)

Appl. Ther.
Applied Therapeutics (Canada)

Arbeitsgemeinsch. Forsch. Landes Nordrhein-Westfalen
Arbeitsgemeinschaft fuer Forschung des Landes Nordrhein-Westfalen (West Germany)

Arbeitsmed. - Sozialmed. - Arbeitshyg.
Arbeitsmedizin - Sozialmedizin - Arbeitshygiene (West Germany)

Arbok Univ. Bergen, Mat.-Natur. Ser.
Arbok for Universitetet i Bergen, Matematik-Naturvitenskapelig Serie (Norway)

Archaeometry
Archaeometry (England)

Arch. Anat. Histol. Embryol. Norm. Exp.
Archives d'Anatomie, d'Histologie et d'Embryologie Normales et Experimentales (France)

Arch. Anat. Microscop. Morphol. Exp.
Archives Danatomie Microscopique et de Morphologie Experimental (France)

Arch. Automat. Telemech.
Archiwum Automatyki i Telemechaniki (Poland)

Arch. Belg. Med. Soc., Hyg., Med. Trav. Med. Leg.
Archives Belges de Medecine Sociale, Hygiene, Medecine du Travail et Medecine Legale (Belgium)

Arch. Biochem. Biophys.
Archives of Biochemistry and Biophysics (U.S.)

Arch. Biol. (Liege)
Archives de Biologie (Liege) (Belgium)

Arch. Biol. Med. Exp.
Archivos de Biologia y Medicina Experimentales. (Chile)

Arch. Dermatol.
Archives of Dermatology (U.S.)

Arch. Eisenhuettenw.
Archiv fuer das Eisenhuettenwesen (West Germany)

Arch. Elektrotech. (Berlin)
Archiv fuer Elektrotechnik (Berlin) (West Germany)

Arch. Elektrotech. (Warsaw)
Archiwum Elektrotechniki (Warsaw) (Poland)

Arch. Elek. Uebertrag.
Archiv der Elektrischen Uebertragung (West Germany)

Arch. Entwicklungsmech. Organ.
Archiv fuer Entwicklungsmechanik der Organismen, Wilhelm Roux (West Germany)

Arch. Environ. Health
Archives of Environmental Health (Formerly A.M.A. Archives of Industrial Health) (U.S.)

XUM

Arch. Exp. Veterinaermed.
Archiv fuer Experimentelle Veterinaermedizin (East Germany)

Arch. Gefluegelk.
Archiv fuer Gefluegelkunde (West Germany)

Arch. Gen. Psychiat.
Archives of General Psychiatry. (U.S.)

Arch. Gesam. Virusforsch.
Archiv fuer die Gesamte Virusforschung (Austria)

Arch. Geschwulstforsch.
Archiv fuer Geschwulstforschung (East Germany)

Arch. Histol. Jap.
Archivum Histologicum Japonicum (Japan)

Arch. Hyg. Bakteriol.
Archiv fuer Hygiene und Bakteriologie (West Germany)

Arch. Immunol. Ther. Exp.
Archivum Immunologiae et Therapiae Experimentalis (Poland)

Arch. Intern. Med.
Archives of Internal Medicine. (U.S.)

Arch. Int. Pharmacodyn.
Archives Internationales de Pharmacodynamie et de Therapie. (Belgium)

Arch. Int. Physiol. Biochim.
Archives Internationales de Physiologie et de Biochimie (Belgium)

Arch. Ital. Chir.
Archivio Italiano di Chirurgia (Italy)

Arch. Ital. Otol., Rinol., Laringol.
Archivio Italiano di Otologia, Rinologia e Laringologia (Italy)

Arch. Ital. Patol. Clin. Tumori
Archivo Italiano di Patologia e Clinica dei Tumori (Italy)

Arch. Kinderheilk.
Archiv fuer Kinderheilkunde (West Germany)

Arch. Klin. Chir.
Archiv fuer Klinische Chirurgie, Langenbecks (West Germany)
Changed to Langenbecks Archiv fuer Chirurgie

Arch. Klin. Exp. Dermatol.
Archiv fuer Klinische und Experimentelle Dermatologie (West Germany)

Arch. Klin. Exp. Ohren-, Nasen- Kehlkopfheilk.
Archiv fuer Klinische und Experimentelle Ohren-, Nasen- und Kehlkopfheilkunde (West Germany)

Arch. Klin. Exp. Ophthalmol.
Archiv fuer Klinische und Experimentelle Ophthalmologie (West Germany)

Arch. Klin. Med.
Archiv fuer Klinische Medizin (West Germany)
Superseded by European Journal of Clinical Investigations

Arch. Mal. Coeur Vaiss.
Archives des Maladies du Coeur et des Vaisseaux (France)

Arch. Mal. Prof. Med. Trav. Secur. Sociale
Archives des Maladies Professionnelles de Medicine du Travail et de Securite Sociale (France)

Arch. Mech. Stosow.
Archiwum Mechaniki Stosowanej (Poland)

Arch. Meteorol., Geophys. Bioklimatol., Ser. A
Archiv fuer Meteorologie, Geophysik und Bioklimatologie Series A (Austria)

Arch. Meteorol., Geophys. Bioklimatol., Ser. B
Archive fuer Meteorologie, Geophysik und Bioklimatologie, Series B (Austria)

Arch. Mikrobiol.
Archiv fuer Mikrobiologie (West Germany)

Arch. Neurol.
Archives of Neurology. (U.S.)

Arch. Oceanogr. Limnol.
Archivio di Oceanografia e Limnoligia (Italy)

Arch. Ophthalmol. (Chicago)
Archives of Ophthalmology (Chicago) (U. S.)

Arch. Oral Biol.
Archives of Oral Biology (England)

Arch. Orthopaed. Unfallchir.
Archiv fuer Orthopaedische und Unfallchirurgie (West Germany)

Arch. Ortop.
Archivio di Ortopedia (Italy)

Arch. Otolaryngol.
Archives of Otolaryngology (U.S.)

Arch. Pathol.
Archives of Pathology (Formerly A.M.A. Archives of Pathology) (U.S.)

Arch. Pathol. Anat.
Archiv fuer Pathologisches Anatomie und Physiologie fuer Klinische Medizin, Virchows (West Germany)
Superseded by Virchows Archiv, A

Arch. Pharmakol. Exp. Pathol.
Archiv fuer Pharmakologie und Experimentelle Pathologie (Formerly Archiv fuer Experimentelle Pathologie und Pharmakologie, Naunyn-Schmiedebergs) (West Germany)

Arch. Pharm. Chemi
Archiv for Pharmaci og Chemi (Denmark)

Arch. Phys. Ther. (Leipzig)
Archiv fuer Physikalische Therapie, Balneologie und Klimatologie (Leipzig) (East Germany)

Arch. Protistenk.
Archiv fuer Protistenkunde (East Germany)

Arch. Psychiat. Nervenkr.
Archiv fuer Psychiatrie und Nervenkrankheiten Vereinigt mit Zeitschrift fuer die Gesamte Neurologie und Psychiatrie (West Germany)

Arch. Ration. Mech. Anal.
Archive for Rational Mechanics and Analysis (West Germany)

Arch. Roum. Pathol. Exp. Microbiol.
Archives Roumaines de Pathologie Experimentale et de Microbiologie (France)

Arch. Sci. (Geneva)
Archives des Sciences (Geneva) (Switzerland)

Arch. Sci. Med.
Archivio per le Scienze Mediche (Italy)

Arch. Sci. Physiol.
Archives des Sciences Physiologiques (France)

Arch. Soc. Biol. Montevideo
Archivos de la Sociedad de Biologia de Montevideo (Uruguay)

Arch. Surg. (Chicago)
Archives of Surgery (Chicago) (U. S.)

Arch. Tierernaehr.
Archiv fuer Tierernaehrung (East Germany)

Arch. Toxikol.
Archiv fuer Toxikologie (West Germany)

Arch. Vet. Ital.
Archivio Veterinario Italiano (Italy)

Arcisp. S. Anna di Ferrara
Arcispedale S. Anna di Ferrara (Italy)

Arctic Alpine Res. (Boulder, Colo.)
Arctic and Alpine Research (Boulder, Colorado) (U.S.)

Arerugi
Arerugi (Japanese Journal of Allergy) (Japan)

Argonne Nat. Lab. Rev.
Argonne National Laboratory Reviews (Supersedes News-Bulletin International (Argonne National Laboratory)) (U. S.)
Changed to Argonne Reviews

Arh. Hig. Rada Toksikol.
Arhiv za Higijenu Rada i Toksikologiju (Yugoslavia)

Arh. Poljopr. Nauke
Arhiv za Poljoprivredne Nauke (Yugoslavia)

Ark. Astron.
Arkiv for Astronomi, Utgivet av Kungliga Svenska Vetenskapsakademien (Sweden)

Ark. Fys.
Arkiv for Fysik, Utgivet au Kungliga Svenska Vetenskapsakademien (Sweden)
Superseded by Physica Scripta

Ark. Fys. Seminar Trondheim
Arkiv for det Fysiske Seminar i Trondheim (Norway)

Ark. Geofys.
Arkiv for Geofysik, Utgivet av Kungliga Svenska Vetenskapsakademien (Sweden)

Arkh. Anat., Gistol. Embriol.
Arkhiv Anatomii, Gistologii i Embriologii (U.S.S.R.)

Arkhimedes
Arkhimedes (Finland)

Arkh. Patol.
Arkhiv Patologii (U.S.S.R.)

Ark. Kem.
Arkiv for Kemi, Utgivet av Kungliga Svenska Vetenskapakademien (Sweden)

Arm. Khim. Zh.
Armyanskii Khimicheskii Zhurnal (Formerly Izvestiya Akademii Nauk Armyanskoi SSR, Khimicheskie Nauk) (Armenian S.S.R.)

Arq. Patol. (Lisbon)
Arquivos de Patologia (Lisbon) (Portugal)

Ars Pharm.
Ars Pharmaceutica (Spain)

Arthritis Rheum.
Arthritis and Rheumatism (U.S.)

Artif. Satell.
Artificial Satellites (Poland)

Arts Mfr.
Arts et Manufactures (France)

Arzneim.-Forsch.
Arzneimittel-Forschung. Drug Research (West Germany)

Asahi Garasu Kenkyu Hokoku
Asahi Garasu Kenkyu Hokoku (Reports of the Research Lab., Asahi Glass Co.) (Japan)

Asahi Garasu Kogo Gijutsu Shoreikai Kenkyu Hokoku
Asahi Garasu Kogo Gijutsu Shoreikai Kenkyu Hokoku (Annual Report of the Asahi Glass Foundation for Contributions to Industrial Technology) (Japan)

ASEA (Allm. Sv. Elek. A. B.) J.
ASEA (Allmaenna Svenska Elektriska Aktiebolsget) Journal (Sweden)

ASEA (Allm. Sv. Elek. A. B.) Res.
ASEA (Allmaenna Svenska Elektriska Aktiebolaget) Research (Sweden)

ASEA's (Allmanna Sv. Elek. A. B.) Tidn.
ASEA's (Allmanna Svenska Elektriska Aktiebolaget) Tidning (Sweden)

ASLE (Amer. Soc. Lubric. Eng.) Trans.
ASLE (American Society of Lubrication Engineers) Transactions (U.S.)

ASM (Amer. Soc. Metals), Trans. Quart.
ASM (American Society for Metals), Transactions Quarterly (Formerly Transactions of the American Society for Metals) (U.S.)
Superseded by Metallurgical Transactions

Ass. Geofis. Ital., Atti Conv. Annu.
Associazione Geofisica Italiana, Atti del Convegno Annuale (Italy)

Astron. Astrophys.
Astronomy and Astrophysics (Formed by the Merging of Annales d'Astrophysique, Bulletin of the Astronomical Institutes of the Netherlands, Bulletin Astronomique, Journal des Observateurs, and Zeitschrift fuer Astrophysik) (West Germany - U.S.)

Astron. Astrophys., Suppl. Ser.
Astronomy and Astrophysics, Supplement Series (Netherlands)

Astronaut. Acta
Astronautica Acta (Austria)

Astronaut. Aeronaut.
Astronautics and Aeronautics (Formerly Astronautics and Aerospace Engineering) (U.S.)

Astron. J.
Astronomical Journal, The (U.S.)

Astron. Nachr.
Astronomische Nachrichten (East Germany)

Astronomie
Astronomie, L (France)

Astron. Raumfahrt
Astronomie und Raumfahrt (West Germany)

Astron. Soc. Jap., Publ.
Astronomical Society of Japan, Publications (Japan)

Astron. Vestn.
Astronomicheskii Vestnik (U.S.S.R.)

Astrophysics (Engl. Transl.)
Astrophysics (English Translation of Astrofizika) (U.S.)

Astrophys. J.
Astrophysical Journal, The (U.S.)

Astrophys. J., Suppl. Ser.
Astrophysical Journal, The, Supplement Series (U.S.)

Astrophys. Lett.
Astrophysical Letters (Scotland)

Astrophys. Space Sci.
Astrophysics and Space Science (Netherlands)

At. Absorption Newslett.
Atomic Absorption Newsletter (U.S.)

At. Data
Atomic Data (U.S.)

Ateneo Parmense, Sez. 1
Ateneo Parmense, Sezione 1. Acta Bio-Medica (Italy)

At. Energ. (USSR)
Atomnaya Energiya (U.S.S.R.)
Issued in English Translation as Soviet Journal of Atomic Energy, The

At. Energy Aust.
Atomic Energy in Australia (Australia)

At. Energy Rev.
Atomic Energy Review (Austria)

Atmos. Environ.
Atmospheric Environment (England)

Atom (London)
Atom (London) (England)

Atomes (Paris)
Atomes (Paris) (France)

Atomkernenergie
Atomkernenergie (Formerly Atomenergie) (West Germany)

ATOMKI (At. Kut. Intez.) Kozlem.
ATOMKI (Atommag Kutato Intezet) Kozlemenyek (Hungary)

Atompraxis
Atompraxis (West Germany)

Atomtech. Tajek.
Atomtechnikai Tajekoztato (Hungary)

Atomu
Atomu (Atom (Tokyo)) (Japan)

Atomwirt., Atomtech.
Atomwirtschaft, Atomtechnik
(Formerly Atomwirtschaft, Die) (West Germany)

Atomwirtschaft
Atomwirtschaft, Die (West Germany)
Superseded by Atomwirtschaft, Atomtechnik (West Germany)

Atoomenergie Haar Toepass.
Atoomenergie en Haar Toepassingen (Formerly RCN Bulletin) (Netherlands)

At. Strom
Atom und Strom (West Germany)

Atti Accad. Med. Lombarda
Atti della Accademia Medica Lombarda (Italy)

Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Natur.
Atti della Accademia Nazionale dei Lincei, Rendiconti, Classe di Scienze Fisiche, Matematiche e Naturali (Italy)

XUM

Atti Accad. Sci. Lett. Palermo
Atti dell Accademia'di Scienze Lettere e Arti di Palermo (Italy)

Atti Accad. Sci. Torino. I. Cl. Sci. Fis., Mat. Natur.
Atti della Accademia delle Scienze di Torino. (Part) I. Classe di Scienze Fisiche, Matematiche e Naturali (Italy)

Atti Ass. Genet. Ital.
Atti Associazone Genetica Italiana (Italy)

Atti Notiz. (Publ. in Met. Ital.)
Atti Notizie, Associazione Italiana di Metallurgia (Published in Metallurgia Italiana) (Italy)

Atti Seminar. Mat. Fis. Univ. Modena
Atti del Seminario Matematico e Fisico dell'Universita di Modena (Italy)

Atti Soc. Ital. Sci. Vet.
Atti della Societa Italiana di Scienze Veterinarie (Italy)

Atti Soc. Toscana Sci. Natur. Pisa, Proc. Verb. Mem., Ser. A
Atti della Societa Toscana di Scienze Naturali Residente in Pisa, Processi Verbali e Memorie, Serie A (Italy)

Attual. Ostet. Ginecol.
Attualita di Ostetrica e Ginecologia (Italy)

Aust. Civil Eng.
Australian Civil Engineering (Formerly Australian Civil Engineering and Construction) (Australia)

Aust. Comput. J.
Australian Computer Journal, The (Australia)

Aust. Dent. J.
Australian Dental Journal (Australia)

Aust. Electron. Eng.
Australian Electronics Engineering (Australia)

Aust. J. Agr. Res.
Australian Journal of Agricultural Research (Australia)

Aust. J. Biol. Sci.
Australian Journal of Biological Sciences (Australia)

Aust. J. Chem.
Australian Journal of Chemistry (Australia)

Aust. J. Dermatol.
Australian Journal of Dermatology (Australia)
Superseded by Australasian Journal of Dermatology

Aust. J. Exp. Agr. Anim. Husb.
Australian Journal of Experimental Agriculture and Animal Husbandry (Australia)

Aust. J. Exp. Biol. Med. Sci.
Australian Journal of Experimental Biology and Medical Science, The (Australia)

Aust. J. Instrum. Contr.
Australian Journal of Instrumentation and Control (Formerly Australian Journal of Instrument Technology (Australia)

Aust. J. Phys.
Australian Journal of Physics (Australia)

Aust. J. Phys., Astrophys. Suppl.
Australian Journal of Physics, Astrophysical Supplement (Australia)

Aust. J. Sci.
Australian Journal of Science, The (Australia)
Superseded by Search

Aust. Miner. Ind.
Australian Mineral Industry (Australia)

Aust. Mining
Australian Mining (Australia)

Aust. N. Z. J. Surg.
Australian and New Zealand Journal of Surgery (Australia)

Aust. Phys.
Australian Physicist (Australia)

Australas. Ann. Med.
Australasian Annals of Medicine (Australia)

Australas. Bull. Med. Phys. Biophys.
Australasian Bulletin of Medical Physics and Biophysics (Australia)

Australas. Corros. Eng.
Australasian Corrosion Engineering (Australia)

Australas. Eng.
Australasian Engineer (Australia)

Australas. Inst. Mining Met. Proc.
Australasian Institute of Mining and Metallurgy Proceedings (Australia)

Australas. Radiol.
Australasian Radiology (Formerly Journal of the College of Radiologists of Australasia) (Australia)

Aust. Road Res.
Australian Road Research (Australia)

Aust. Vet. J.
Australian Veterinary Journal (Australia)

Aust. Weld. J.
Australian Welding Journal (Australia)

Automatisme
Automatisme (France)

Automat. Remote Contr. (USSR) (Engl. Transl.)
Automation and Remote Control (USSR) (English Translation of Avtomatika i Telemekhanika) (U.S.)

Automat. Weld. (USSR) (Engl. Transl.)
Automatic Welding (USSR) (English Translation of Avtomaticheskaya Svarka) (U.S.)

Aviat. Week Space Technol.
Aviation Week and Space Technology (U.S.)

Avtomat. Svarka
Avtomaticheskaya Svarka (Ukrainian S.S.R.)
Issued in English Translation as Automatic Welding (USSR)

Azerb. Khim. Zh.
Azerbaidzhanskii Khimicheskii Zhurnal (Azerbaidzhan S.S.R.)

Azerb. Med. Zh.
Azerbaidzhanskii Meditsinskii Zhurnal (Azerbaidzhan S.S.R.)

B

Bacteriol. Rev.
Bacteriological Reviews (U.S.)

Banyaszat
Banyaszat (Formerly Banyaszati Lapok) (Hungary)

Battelle Tech. Rev.
Battelle Technical Review (U.S.)
Superseded by Battelle Research Outlook

Bayer. Landwirt. Jahrb.
Bayerisches Landwirtschaftliches Jahrbuch (West Germany)

BBC-Nachr.
BBC-Nachrichten (Switzerland)

Beitr. Biol. Pflanz.
Beitraege zur Biologie der Pflanzen (West Germany)

Beitr. Geophys.
Beitraege zur Geophysik, Gerlands (East Germany)

Beitr. Klin. Erforsch. Tuberk.
Beitraege zur Klinik und Erforschung der Tuberkulose und der Lungenkrankheiten (West Germany)

Beitr. Orthop. Traumatol.
Beitraege zur Orthopaedie und Traumatologie (East Germany)

Beitr. Pathol. Anat. Allg. Pathol.
Beitraege zur Pathologischen Anatomie und zur Allgemeinen Pathologie (West Germany)

Beitr. Phys. Atmos.
Beitraege zur Physik der Atmosphere (West Germany)

Beitr. Plasmaphys.
Beitraege aus der Plasmaphysik (East Germany)

Beitr. Silikose-Forsch.
Beitraege zur Silikose-Forschung (West Germany)

Belgicatom, Ass. Belge Develop. Pac. Energ. At., Bull. Inform.
Belgicatom, Association Belge pour le Developpment Pacifique

de l'Energie Atomique, Bulletin d'Information (Belgium)
Superseded by Bulletin Belgicatom

Bell Lab. Rec.
Bell Laboratories Record (U.S.)

Ber. Bunsenges. Phys. Chem.
Berichte der Bunsengesellschaft fuer Physikalische Chemie (Formerly Zeitschrift fuer Elektrochemie) (West Germany)

Ber. Deut. Bot. Ges.
Berichte der Deutschen Botanischen Gesellschaft (West Germany)

Ber. Deut. Keram. Ges.
Berichte der Deutschen Keramischen Gesellschaft E. V. (West Germany)

Ber., Deut. Opthalmol. Ges.
Bericht, Deutsche Opthalmologische Gesellschaft (West Germany)

Berg- Huettenmaenn. Monatsh.
Berg- und Huettenmaennische Monatshefte (Austria)

Berlin. Muenchen. Tieraerztl. Wochenschr.
Berliner und Muenchener Tieraerztliche Wochenschrift (West Germany)

Ber. Phys.-Med. Ges. Wuerzburg
Berichte der Physikalisch-Medizinischen Gesellschaft zu Wuerzburg (West Germany)

Berufsdermatosen
Berufsdermatosen. Occupational Dermatoses (West Germany)

Beton Stahlbetonbau
Beton- und Stahlbetonbau (West Germany)

Beton Zhelezobeton
Beton i Zhelezobeton (Georgian S.S.R.)

Bibl. Haematol.
Bibliotheca Haematologica, Supplements ad Acta Haematologica (Switzerland)

Bild Wiss.
Bild der Wissenschaft (West Germany)

Biochem. Biophys. Res. Commun.
Biochemical and Biophysical Research Communications (U.S.)

Biochem. Genet.
Biochemical Genetics (U.S.)

Biochemistry
Biochemistry (U.S.)

Biochemistry (USSR) (Engl. Transl.)
Biochemistry (USSR) (English Translation of Biokhimiya) (U.S.)

Biochem. J.
Biochemical Journal (England)

Biochem. Med.
Biochemical Medicine (U.S.)

Biochem. Pharmacol.
Biochemical Pharmacology (England)

Biochim. Biol. Sper.
Biochimica e Biologia Sperimentale (Italy)

Biochim. Biophys. Acta
Biochimica et Biophysica Acta (Netherlands)

Biokhimiya
Biokhimiya (U.S.S.R.)
For English Translation see Biochemistry (USSR) (U.S.)

Biol. Bull.
Biological Bulletin, The (U.S.)

Biol. Nauki
Biologicheskie Nauki (U.S.S.R.)

Biologia (Bratislava)
Biologia (Bratislava) (Czechoslovakia)

Biol. Plant. (Prague)
Biologia Plantarum (Prague) (Czechoslovakia)

Biol. Reprod.
Biology of Reproduction (U. S.)

Biol. Vestn.
Bioloski Vestnik (Yugoslavia)

Biol. Zh. Arm.
Biologicheskii Zhurnal Armenii (Formerly Izvestiya Akademii Nauk Armyanskoi SSR, Biologicheskie Nauki) (Armenian S.S.R.)

Bio-Med. Eng.
Bio-Medical Engineering (England)

Biometrics
Biometrics (U.S.)

Biophysics (USSR) (Engl. Transl.)
Biophysics (USSR) (English Translation of Biofizika) (England)

Biophysik
Biophysik (West Germany)

Biophys. J.
Biophysical Journal (U.S.)

Biopolymers
Biopolymers (U.S.)

Bioscience
Bioscience (U.S.)

Bitamin
Bitamin (Vitamins) (Japan)

Blood
Blood. The Journal of Hematology (U.S.)

Blut
Blut. Zeitschrift fuer Blutforschung. (West Germany)

BNX Rev.
BNX Review (England)
Ceased Publication in 1968

Bodenkultur
Bodenkultur, Die (Austria)

Bol. Chil. Parasitol.
Boletin Chileno de Parasitologia (Chile)

Bol. Inst. Estud. Med. Biol. (Mex.)
Boletin del Instituto de Estudios Medicos y Biologicos (Mexico)

Bol. Inst. Mat., Astron. Fis.
Boletin del Instituto de Matematica, Astronomia y Fisica (Argentina)

Boll. Chim. Farm.
Bollettino Chimico Farmaceutico (Italy)

Boll. Sci. Med.
Bollettino delle Scienze Mediche (Italy)

Boll. Soc. Ital. Biol. Sper.
Bollettino della Societa Italiana di Biologia Sperimentale (Italy)

Boll. Zool.
Bollettino di Zoologia. Pubblicato dall'Unione Zoologica Italiana (Italy)

Boll. Zool. Agr. Bachicolt.
Bollettino di Zoologia Agraria e di Bachicoltura (Italy)

Bol. Ofic. Sanit. Panamer.
Boletin de la Oficina Sanitaria Panamericana (U.S.)

Boshogu Gijutsu
Boshogu Gijutsu (Corrosion Engineering) (Japan)

Bot. Gaz. (Chicago)
Botanical Gazette, The (Chicago) (U. S.)

Bot., Issled., Beloruss. Otd. Vses. Bot. Obshchest.
Botanika, Issledovaniya, Belorusskoe Otdelenie Vsesoyuznogo Botanicheskogo Obshchestva (Belorussian S.S.R.)

Bot. Mag. (Tokyo)
Botanical Magazine, The (Tokyo) (Japan)

Bot. Zh.
Botanicheskii Zhurnal (U.S.S.R.)

Brain Res.
Brain Research (Netherlands)

XUM

Bratislav. Lek. Listy
Bratislavske Lekarske Listy (Czechoslovakia)

Brennst.-Waerme-Kraft
Brennstoff-Waerme-Kraft (West Germany)

Brigham Young Univ. Sci. Bull., Biol. Ser.
Brigham Young University Science Bulletin, Biological Series (U.S.)

Brit. Corros. J.
British Corrosion Journal (England)

Brit. Dent. J.
British Dental Journal (England)

Brit. J. Appl. Phys.
British Journal of Applied Physics (England)
Superseded by Journal of Physics, D

Brit. J. Cancer
British Journal of Cancer (England)

Brit. J. Dermatol.
British Journal of Dermatology. (England)

Brit. J. Exp. Pathol.
British Journal of Experimental Pathology (England)

Brit. J. Haematol.
British Journal of Haematology (England)

Brit. J. Hosp. Med.
British Journal of Hospital Medicine (England)
Supersedes Hospital Medicine

Brit. J. Ind. Med.
British Journal of Industrial Medicine (England)

Brit. J. Non-Destruct. Test.
British Journal of Non-Destructive Testing (England)

Brit. J. Ophthalmol.
British Journal of Ophthalmology (England)

Brit. J. Oral Surg.
British Journal of Oral Surgery (Scotland)

Brit. J. Radiol.
British Journal of Radiology (England)

Brit. J. Surg.
British Journal of Surgery, The (England)

Brit. J. Urol.
British Journal of Urology, The (Scotland)

Brit. Med. Bull.
British Medical Bulletin (England)

Brit. Med. J.
British Medical Journal, The (England)

Brit. Mycol. Soc. Trans.
British Mycological Society Transactions, The (England)

Brit. Vet. J.
British Veterinary Journal, The (England)

Brown Boveri Rev.
Brown Boveri Review (Switzerland)

Bruns Beitr. Klin. Chir.
Bruns Beitraege zur Klinischen Chirurgie (West Germany)

Bryologist
Bryologist (U.S.)

Bul. Inst. Politeh. Bucuresti
Buletinul Institutului Politehnic Bucuresti (Romania)
Superseded by Buletinul Institutului Politehnic Georghe Gheorghiu-Dej Bucuresti

Bul. Inst. Politeh. Gheorghe Gheorghiu-Dej Bucuresti
Buletinul Institutului Politehnic Gheorghe Gheorghiu-Daj Bucuresti (Romania)

Bul. Inst. Politeh. Iasi
Buletinul Institutului Politehnic din Iasi (Romania)

Bull. Acad. Nat. Med. (Paris)
Bulletin de l'Academie Nationale de Medecine (Paris)

Bull. Acad. Pol. Sci., Ser. Sci. Biol.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Biologiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Chim.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Chimiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Geol. Geogr.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Geologiques et Geographiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences, Mathematiques, Astronomiques et Physiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Tech.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Techniques (Poland)

Bull. Acad. Roy. Med. Belg.
Bulletin de l'Academie Royale de Medecine de Belgique (Belgium)

Bull. Amer. Math. Soc.
Bulletin of the American Mathematical Society (U.S.)

Bull. Amer. Meteorol. Soc.
Bulletin of the American Meteorological Society (U.S.)

Bull. Astron.
Bulletin Astronomique (France)
Superseded by Astronomy and Astrophysics

Bull. Astron. Inst. Czech.
Bulletin of the Astronomical Institutes of Czechoslovakia (Czechoslovakia)

Bull. Astron. Inst. Neth.
Bulletin of the Astronomical Institutes of the Netherlands (Netherlands)
Superseded by Astronomy and Astrophysics

Bull. Belgicatom
Bulletin Belgicatom (Formerly Belgicatom, Association Belge pour le Developpement Pacifique de l'Energie Atomique, Bulletin d'Information) (Belgium)

Bull. Belg. Phys. Soc.
Bulletin of the Belgian Physical Society (Formerly Bulletin de la Societe Belge de Physique) (Belgium)
Ceased Publication

Bull. Boris Kidric Inst. Nucl. Sci., Biol.
Bulletin of the Boris Kidric Institute of Nuclear Sciences, Biology (Yugoslavia)

Bull. Boris Kidric Inst. Nucl. Sci., Ceram. Met.
Bulletin of the Boris Kidric Institute of Nuclear Sciences, Ceramics and Metallurgy (Yugoslavia)

Bull. Boris Kidric Inst. Nucl. Sci., Chem.
Bulletin of the Boris Kidric Institute of Nuclear Sciences, Chemistry (Yugoslavia)

Bull. Boris Kidric Inst. Nucl. Sci., Electron.
Bulletin of the Boris Kidric Institute of Nuclear Sciences, Electronics (Yugoslavia)

Bull. Boris Kidric Inst. Nucl. Sci., Nucl. Eng.
Bulletin of the Boris Kidric Institute of Nuclear Sciences, Nuclear Engineering (Yugoslavia)

Bull. Brew. Sci.
Bulletin of Brewing Science (Japan)

Bull. Cancer
Bulletin du Cancer (Formerly Bulletin de l'Association Francaise pour l'Etude du Cancer) (France)

Bull. Cent. Rech. Essais Chatou
Bulletin du Centre de Recherches et d'Essais de Chatou (France)

Bull. Chem. Soc. Jap.
Bulletin of the Chemical Society of Japan (Japan)

Bull. Chest Dis. Res. Inst., Kyoto Univ.
Bulletin of Chest Disease Research Institute, Kyoto University (Japan)

Bull. Cl. Sci., Acad. Roy. Belg.
Bulletin de la Classe des Sciences, Academie Royale de Belgique (Belgium)

Bull. Dir. Etud. Rech., Ser. A
Bulletin de la Direction des Etudes et Recherches, Serie A (France)

Bull. Dir. Etud. Rech., Ser. B
Bulletin de la Direction des Etudes et Recherches, Serie B (France)

Bull. EGU
Bulletin EGU (Vyzkumny Ustav Energeticky) (Czechoslovakia)

Bull. Entomol. Res.
Bulletin of Entomological Research (England)

Bull. Fac. Educ., Utsunomiya Univ.
Bulletin of the Faculty of Eduction, Utsunomiya University (Japan)

Bull. Fac. Eng., Tokushima Univ.
Bulletin of Faculty of Engineering, Tokushima University (Japan)

Bull. Ga. Acad. Sci.
Bulletin of the Georgia Academy of Science (U.S.)

Bull. Geisinger Med. Cent. (Danville, Pa.)
Bulletin of the Geisinger Medical Center (Danville, Pennsylvania) (U.S.)

Bull. Group. Int. Rech. Sci. Stomatol.
Bulletin du Groupment International pour la Recherche Scientifique en Stomatologie (Belgium)

Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.)
Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire) (France)

Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.), Suppl.
Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire), Supplement (France)

Bull. Inform. Sci. Tech. (Paris)
Bulletin d'Information Scientifique et Technique (Paris) (France)

Bull. Inst. Chem., Acad. Sinica
Bulletin of the Institute of Chemistry, Academia Sinica (Taiwan) (China)

Bull. Inst. Chem. Res., Kyoto Univ.
Bulletin of the Institute for Chemical Research, Kyoto University (Japan)

Bull. Inst. Nat. Sante Rech. Med.
Bulletin de l'Institut National de la Sante et de la Recherche Medicale (France)

Bull. Instrum. Nucl.
Bulletin Instrumentation Nucleaire (Formerly Instrumentation Nucleiaire) Supplement au Bulletin d'Informations Scientifiques et Techniques (France)

Bull. Int. Ass. Sci. Hydrol.
Bulletin of the International Association of Scientific Hydrology (Belgium)

Bull. JSME (Jap. Soc. Mech. Eng.)
Bulletin of JSME (Japan Society of Mechanical Engineers) (Japan)

Bull. Kyushu Inst. Technol., Math., Natur. Sci.
Bulletin of the Kyushu Inst. of Technology, Mathematics, Natural Science (Japan)

Bull. Los Angeles Neurol. Soc.
Bulletin of the Los Angeles Neurological Society (U.S.)

Bull. Nat. Geophys. Res. Inst.
Bulletin of the National Geophysical Research Institute (India)

Bull. N. Y. Acad. Med.
Bulletin of the New York Academy of Medicine (U.S.)

Bull. Parenter. Drug Ass.
Bulletin of the Parenteral Drug Association (U.S.)

Bull. Schweiz. Akad. Med. Wiss.
Bulletin der Schweizerischen Akademie der Medizinischen Wissenschaften (Switzerland)

Bull. Schweiz. Elektrotech. Ver.
Bulletin des Schweizerischen Elektrotechnischen Veriens (Switzerland)

Bull. Sci., Sect. A
Bulletin Scientifique, Section A. Sciences Naturelles, Techniques et Medicales (Yugoslavia)

Bull. Seismol. Soc. Amer.
Bulletin of the Seismological Society of America (U.S.)

Bull. Soc. Belge Geol. Paleontol. Hydrol.
Bulletin de la Societe Belge de Geologie, de Paleontologie et d'Hydrologie (Belgium)

Bull. Soc. Chim. Belg.
Bulletin des Societes Chimiques Belges (Belgium)

Bull. Soc. Chim. Beograd
Bulletin de la Societe Chimique Beograd (Formerly carried under title: Glasnik Hemiskog Drustva, Beograd) (Yugoslavia)

Bull. Soc. Chim. Biol.
Bulletin de la Societe de Chimie Biologique. (France)

Bull. Soc. Chim. Fr.
Bulletin de la Societe Chimique de France (France)

Bull. Soc. Chir. Paris
Bulletin de la Societe de Chirurgie de Paris (France)

Bull. Soc. Fr. Ceram.
Bulletin de la Societe Francaise de Ceramique (France)

Bull. Soc. Fr. Dermatol. Syphiligr.
Bulletin de la Societe Francaise de Dermatologie et de Syphiligraphie (France)

Bull. Soc. Fr. Miner. Crist.
Bulletin de la Societe Francaise de Mineralogie et de Cristallographie (France)

Bull. Soc. Med. Afr. Noire Langue Fr.
Bulletin de la Societe Medicale d Afrique Noire de Langue Francaise (Senegal)

Bull. Soc. Med. Hop. Paris
Bulletins et Memoires da la Societe Medicale des Hopitaux de Paris (France)

Bull. Soc. Roy. Sci. Liege
Bulletin de la Societe Royale des Sciences de Liege (Belgium)

Bull. Tokyo Gakugei Univ.
Bulletin of the Tokyo Gakugei University (Japan)

Bull. Tokyo Gakugei Univ., Ser. 4
Bulletin of the Tokyo Gakugei University, Series 4 (Japan)

Bull. Tokyo Inst. Technol. (Engl. Ed.)
Bulletin of the Tokyo Institute of Technology (English Edition) (Not the same publication as Tokyo Kogyo Daigaku Gakuho) (Japan)

Bull. Tokyo Med. Dent. Univ.
Bulletin of Tokyo Medical and Dental University (Japan)

Bull. Ver. Schweiz. Petrol.-Geol. -Ing.
Bulletin der Vereinigung der Schweizerischen Petroleum-Geologen und -Ingenieure (Switzerland)

Bull. Volcanol.
Bulletin Volcanologique (Italy)

Bull. Yamaguchi Med. Sch.
Bulletin of the Yamaguchi Medical School (Japan)

Bul. Stiint. Teh. Inst. Politeh. Timisoara
Buletinul Stiintific si Tehnic al Institutului Politehnic Timisoara (Romania)

Bunko Kenkyu
Bunko Kenkyu (Journal of the Spectroscopical Society of Japan) (Japan)

Bunseki Kiki
Bunseki Kiki (Analysis and Instrument) (Japan)

Byull. Eksp. Biol. Med.
Byulleten Eksperimental'noi Biologii i Meditsiny (U.S.S.R.) For English Translation see Bulletin of Experimental Biology and Medicine (USSR)

Byull. Mosk. Obshch. Ispyt. Prir., Otd. Biol.
Byulleten Moskovskogo Obshchestva Ispytatelei Prirody, Otdel Biologicheskii (U.S.S.R.)

Byull. Tekh.-Ekon. Inform., Gos. Nauch.-Issled. Inst. Nauch. Tekh. Inform.
Byulleten Tekhniko-Ekonomicheskoi Informatsii, Gosudarstvennyi Nauchno-Issledovatel'skii Institut Nauchnoi i Tekhnicheskoi Informatsii (U.S.S.R.)

XUM

C

CA - Cancer J. Clin.
CA - Cancer Journal for Clinicians (Formerly CA - A Medical Journal Published by the American Cancer Society) (U.S.)

Cah. Ing. Agron.
Cahiers des Ingenieurs Agronomes (France)

Cah. Phys.
Cahiers de Physique (France)
Ceased Publication

Calcified Tissue Res.
Calcified Tissue Research (West Germany)

Cancer
Cancer (U.S.)

Cancer Bull.
Cancer Bulletin (U.S.)

Cancer Chemother. Rep.
Cancer Chemotherapy Reports (U.S.)

Cancer Res.
Cancer Research (U.S.)

Can. Chem. Process.
Canadian Chemical Processing (Canada)

Can. Contr. Instrum.
Canadian Controls and Instrumentation (Canada)

Cancro
Cancro, Il (Italy)

Can. Hosp.
Canadian Hospital (Canada)

Can. J. Biochem.
Canadian Journal of Biochemistry (Supersedes in Part Canadian Journal of Biochemistry and Physiology) (Canada)

Can. J. Bot.
Canadian Journal of Botany. (Canada)

Can. J. Chem.
Canadian Journal of Chemistry (Canada)

Can. J. Chem. Eng.
Canadian Journal of Chemical Engineering (Formerly Canadian Journal of Technology) (Canada)

Can. J. Earth Sci.
Canadian Journal of Earth Sciences (Canada)

Can. J. Genet. Cytol.
Canadian Journal of Genetics and Cytology (Canada)

Can. J. Microbiol.
Canadian Journal of Microbiology (Canada)

Can. J. Ophthalmol.
Canadian Journal of Ophthalmology (Canada)

Can. J. Phys.
Canadian Journal of Physics (Canada)

Can. J. Physiol. Pharmacol.
Canadian Journal of Physiology and Pharmacology (Supersedes in Part Canadian Journal of Biochemistry and Physiology) (Canada)

Can. J. Soil Sci.
Canadian Journal of Soil Science (Canada)

Can. J. Zool.
Canadian Journal of Zoology (Canada)

Can. Mach. Metalwork.
Canadian Machinery and Metalworking (Canada)

Can. Med. Ass. J.
Canadian Medical Association Journal, The (Canada)

Can. Met. Quart.
Canadian Metallurgical Quarterly (Canada)

Can. Mining J.
Canadian Mining Journal (Canada)

Can. Mining Met. Bull.
Canadian Mining and Metallurgical Bulletin, The (Canada)
Superseded by CIM (Can. Mining Met.) Bull.

Can. Res. Develop.
Canadian Research and Development (Formerly Canadian Nuclear Technology) (Canada)

Can. Spectrosc.
Canadian Spectroscopy (Canada)

Can. Vet. J.
Canadian Veterinary Journal (Canada)

Carbon
Carbon (England)

Caries Res.
Caries Research (Switzerland)

Caryologia
Caryologia (Italy)

Cas. Lek. Cesk.
Casopis Lekaru Ceskych (Czechoslovakia)

Catal. Rev.
Catalysis Reviews (U. S.)

Cell Tissue Kinet.
Cell and Tissue Kinetics (England)

Celul. Hirtie
Celuluza si Hirtie (Romania)

Cent. Eur. Fed.
Central European Federalist (U.S.)

Ceram. Age
Ceramic Age (U.S.)

Cercet. Met.
Cercetari Metalurgice (Romania)

Cereal Chem.
Cereal Chemistry (U.S.)

Cereal Sci. Today
Cereal Science Today (U.S.)

CERN Cour.
CERN Courier (Switzerland)

Cesk. Cas. Fys.
Ceskoslovensky Casopis pro Fysiku (Czechoslovakia)

Cesk. Farm.
Ceskoslovenska Farmacie (Czechoslovakia)

Cesk. Fysiol.
Ceskoslovenska Fysiologie (Czechoslovakia)

Cesk. Gastroenterol. Vyz.
Ceskoslovenska Gastroenterologie a Vyziva, Sbornik pro Pathofysiologii Traveni a Vyzivy (Czechoslovakia)

Cesk. Gynekol.
Ceskoslovenska Gynekologie (Czechoslovakia)

Cesk. Hyg.
Ceskoslovenska Hygiena (Czechoslovakia)

Cesk. Neurol.
Ceskoslovenska Neurologie (Czechoslovakia)

Cesk. Oftalmol.
Ceskoslovenska Oftalmologie (Czechoslovakia)

Cesk. Otolaryngol.
Ceskoslovenska Otolaryngologie (Czechoslovakia)

Cesk. Radiol.
Ceskoslovenska Radiologie (Formerly Ceskoslovenska Rentgenologie) (Czechoslovakia)

Cesk. Stomatol.
Ceskoslovenska Stomatologie (Czechoslovakia)

Chem. Age India
Chemical Age of India (India)

Chem. Anal. (Warsaw)
Chemia Analityczna (Warsaw) (Poland)

Chem. Brit.
Chemistry in Britain (England)

Chem. Can.
Chemistry in Canada (Canada)

Chem. Commun.
Chemical Communications (England)

Superseded by the Journal of the Chemical Society, D. Chemical Communications

Chem. Eng. News
Chemical Engineering News (U.S.)

Chem. Eng. Progr.
Chemical Engineering Progress (U.S.)

Chem. Eng. Progr., Symp. Ser.
Chemical Engineering Progress, Symposium Series (U.S.)

Chem. Eng. Sci.
Chemical Engineering Science (England)

Chem. Geol.
Chemical Geology (Netherlands)

Chem. Ind. (London)
Chemistry and Industry (London) (England)

Chem.-Ing.-Tech.
Chemie-Ingenieur-Technik (West Germany)

Chem. Instrum.
Chemical Instrumentation (U.S.)

Chemistry
Chemistry (U.S.)

Chem. Listy
Chemicke Listy (Czechoslovakia)

Chem. Pharm. Bull. (Tokyo)
Chemical and Pharmaceutical Bulletin (Tokyo) (Japan)

Chem. Phys. Lett.
Chemical Physics Letters (Netherlands)

Chem. Process. (London)
Chemical Processing (London) (England)

Chem. Prumysl
Chemicky Prumysl (Czechoslovakia)

Chem. Rev.
Chemical Reviews (U.S.)

Chem. Tech. (Leipzig)
Chemische Technik, VEB Deutscher Verlag fuer Grundstoff-Industrie (Leipzig) (East Germany)
Ceased Publication

Chem. Unserer Zeit
Chemie in Unserer Zeit (West Germany)

Chem. Weekbl.
Chemisch Weekblad (Netherlands)

Chem. Ztg.
Chemiker Zeitung (West Germany)

Chem. Zvesti
Chemicke Zvesti (Czechoslovakia)

Chiba Daigaku Bunrigakubu Kiyo, Shizenkagaku
Chiba Daigaku Bunrigakubu Kiyo, Shizenkagaku (Journal of the College of Arts and Science, Chiba University, Natural Science) (Japan)

Chiba Daigaku Kogakubu Kenkyu Hokoku
Chiba Daigaku Kogakubu Kenkyu Hokoku (Journal of Faculty of Engineering, Chiba University) (Japan)

Chiba Igakkai Zasshi
Chiba Igakkai Zasshi (The Journal of Chiba Medical Society) (Japan)

Chicago Med. Sch. Quart.
Chicago Medical School Quarterly (U.S.)

Chih Wu Hsueh Pao
Chih Wu Hsueh Pao (Acta Botanica Sinica) (China)

Chikasui To Ido To Ponpu
Chikasui to Ido to Ponpu (Water Journal) (Japan)

Chim. Anal. (Paris)
Chimie Analytique (Paris) (France)

Chim. Chron. (Athens, Greece)
Chimika Chronika (Athens, Greece) (Greece)

Chimia (Aarau)
Chimia (Aarau) (Switzerland)

Chim. Ind. (Milan)
Chimica e l'Industria, La (Milan) (Italy)

Chim. Ind. (Paris)
Chimie et Industrie (Paris) (France)

Chim. Ind., Genie Chim.
Chimie et Industrie, Genie Chimique (Formed by the Merger of Chimie et Industrie (Paris) and Genie Chimique (Paris)) (France)

Chin. J. Phys. (Peking) (Engl. Transl.)
Chinese Journal of Physics (Peking) (English Translation of Acta Physica Sinica (Wu Li Hsueh Pao)) (U.S.)
Ceased publication

Chin. J. Phys. (Taiwan)
Chinese Journal of Physics (Taiwan) (China)

Chir. Narzadow Ruchu Ortoped. Pol.
Chirurgia Narzadow Ruchu i Ortopedia Polska (Poland)

Chirurg
Chirurg, Der (West Germany)

Chishitsu Chosajo Hokoku
Chishitsu Chosajo Hokoku (Report, Geological Survey of Japan) (Japan)

Chishitsu Chosasho Geppo
Chishitsu Chosasho Geppo (Bulletin of the Geological Survey of Japan) (Japan)

Chromatographia
Chromatographia (West Germany)

Chromosoma
Chromosoma (West Germany)

Chromosome Inform. Serv. (Tokyo)
Chromosome Information Service (Tokyo) (Japan)

Chubu Denryoku K. K. Kenkyu Shiryo
Chubu Denryoku K. K. Kenkyu Shiryo (Memoirs of the Chubu Electric Power Co., Ltd.) (Japan)

Chuko To Tanko
Chuko To Tanko (Casting and Forging of Steel) (Japan)

Chung Hua Nei K'o Tsa Chih
Chung Hua Nei K'o Tsa Chih (Chinese Journal of Internal Medicine) (China)

Ciencia (Mexico)
Ciencia (Mexico), Revista Hispano-Americana de Ciencias Puras y Applicadas (Mexico)

CIM (Can. Mining Met.) Bull.
CIM (Canadian Mining and Metallurgy) Bulletin (Formerly Canadian Mining and Metallurgy Bulletin) (Canada)

Circulation
Circulation (U.S.)

Circulation Res.
Circulation Research. An Official Journal of the American Heart Association (U.S.)

Civil Eng. (N. Y.)
Civil Engineering (New York) (U.S.)

Clay Miner.
Clay Minerals (England)

Clays Clay Miner.
Clays and Clay Minerals (U.S.)

Cleft Palate J.
Cleft Palate Journal (U.S.)

Cleveland Clin. Quart.
Cleveland Clinic Quarterly (U.S.)

Clin. Chem.
Clinical Chemistry (U.S.)

Clin. Chim. Acta
Clinica Chimica Acta (Netherlands)

Clin. Exp. Immunol.
Clinical and Experimental Immunology (England)

Clin. Obstet. Gynecol.
Clinical Obstetrics and Gynecology (U.S.)

Clin. Orthop.
Clinical Orthopaedics (U.S.)

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Clin. Orthop. Related Res.
Clinical Orthopaedics and Related Research (Formerly Clinical Orthopaedics) (U.S.)

Clin. Pediat. (Philadelphia)
Clinical Pediatrics (Philadelphia) (U.S.)

Clin. Pharmacol. Ther.
Clinical Pharmacology and Therapeutics. (U.S.)

Clin. Radiol.
Clinical Radiology (Scotland)

Clin. Sci.
Clinical Science (England)

Clin. Ter.
Clinica Terapeutica (Italy)

CNRM (Cent. Nat. Rech. Met.) Met. Rep.
CNRM (Centre National de Recherches Metallurgiques) Metallurgical Reports (Belgium)

Cobalt
Cobalt (France)

Cold Spring Harbor Symp. Quant. Biol.
Cold Spring Harbor Symposia on Quantitative Biology. (U.S.)

Collect. Czech. Chem. Commun.
Collection of Czechoslovak Chemical Communications (Czechoslovakia)

Colloq. Int. Cent. Nat. Rech. Sci.
Colloques Internationaux du Centre National de la Recherche Scientifique (France)

Colloq. Met., Commis. Energ. At. (Fr.)
Colloque de Metallurgie, Commissariat a l Energie Atomique (France)

Combust. Flame
Combustion and Flame (England)

Combustion
Combustion (U.S.)

Commentat. Phys.-Math.
Commentationes Physico-Mathematicae (Finland)

Comments Astrophys. Space Phys.
Comments on Astrophysics and Space Physics (England - U. S.)

Comments At. Mol. Phys.
Comments on Atomic and Molecular Physics (England - U. S.)

Comments Earth Sci., Geophys.
Comments on Earth Sciences, Geophysics (England)

Comments Nucl. Particle Phys.
Comments on Nuclear and Particle Physics (England - U. S.)

Comments Solid State Phys.
Comments on Solid State Physics (England - U. S.)

Commun. Math. Phys.
Communications in Mathematical Physics (West Germany)

Com. Naz. Energ. Nucl., Notiz.
Comitato Nazionale per l'Energia Nucleare, Notiziario (Italy)

Comp. Biochem. Physiol.
Comparative Biochemistry and Physiology. (U.S.)

Compt. Rend., Ser. A, B
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Series A, et B (France

Compt. Rend., Ser. C
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie C (France)

Compt. Rend., Ser. D
Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, Serie D (France)

Compt. Rend. Acad. Bulg. Sci.
Comptes Rendus de l'Academie Bulgare des Sciences (Bulgaria)

Compt. Rend. Soc. Biol.
Comptes Rendus des Seances de la Societe de Biologie et de ses Filiales (France)

Compt. Rend. Trav. Lab. Carlsberg
Comptes Rendus des Travaux du Laboratoire Carlsberg (Denmark)

Comput. Biomed. Res.
Computers and Biomedical Research (U.S.)

Comput. J.
Computer Journal (England)

Comput. Phys. Commun.
Computer Physics Communications (Netherlands)

Comput. Programs Biomed.
Computer Programs in Biomedicine (Netherlands)

Comun. Bot.
Comunicari de Botanica (Romania)

Confin. Neurol.
Confinia Neurologica Borderland of Neurology (Switzerland)

Conn. Med.
Connecticut Medicine (U.S.)

Constructiematerialen
Constructiematerialen (Netherlands)
Ceased publication with Vol. 3, 1969; Absorbed by Constructeur

Consult. Eng.
Consulting Engineer (England)

Contemp. Phys.
Contemporary Physics (England)

Contr. Eng.
Control Engineering Instrumentation and Automatic Control Systems (U.S.)

Contrib. Geol.
Contributions to Geology (U. S.)

Contrib. Miner. Petrol.
Contributions to Mineralogy and Petrology (West Germany)

Control
Control and Automation Process (England)
Superseded by Control and Instrumentation

Coord. Chem. Rev.
Coordination Chemistry Reviews (Netherlands)

Copeia
Copeia (U.S.)

Copper (London)
Copper (London) (Incorporating Copper Abstracts) (England)

Cornell Vet.
Cornell Veterinarian, The (U.S.)

Cornell Vet., Suppl.
Cornell Veterinarian, Supplement (U.S.)

Corrosion
Corrosion (U.S.)

Corros. Sci.
Corrosion Science (England)

Corros.-Trait., Prot., Finition
Corrosion-Traitements, Protection, Finition (Formerly Corrosion et Anti-Corrosion) (France)

Cosmic Electrodyn.
Cosmic Electrodynamics (Netherlands)

CRC Crit. Rev. Clin. Lab. Sci.
CRC Critical Reviews in Clinical Laboratory Sciences (U. S.)

CRC Crit. Rev. Environ. Contr.
CRC Critical Reviews in Environmental Control (U. S.)

Croat. Chem. Acta
Croatica Chemica Acta (Yugoslavia)

Crop Sci.
Crop Science (U.S.)

Cryobiology
Cryobiology (U. S.)

Cryog. Eng. News
Cryogenic Engineering News (U.S.)
Changed to Cryogenics and Industrial Gases

Cryogenics
Cryogenics (England)

Cryog. Ind. Gases
Cryogenic and Industrial Gases (formerly Cryogenic Engineering News) (U.S.)

Cryst. Lattice Defects
Crystal Lattice Defects (Northern Ireland)

Cuivre, Laitons, Alliages
Cuivre, Laitons, Alliages (France)

Curr. Mod. Biol.
Currents in Modern Biology (Netherlands)

Curr. Sci. (India)
Current Science (India)

Curr. Top. Microbiol. Immunol.
Current Topics in Microbiology and Immunology (Formerly Ergebnisse der Mikrobiologie und Immunitaetsforschung und Experimentellen Therapie) (West Germany)

Curr. Top. Radiat. Res.
Current Topics in Radiation Research (Netherlands)

Cutis (N. Y.)
Cutis (New York) (U. S.)

Cytogenetics
Cytogenetics (Switzerland)

Cytologia (Tokyo)
Cytologia (Tokyo) International Journal of Cytology (Japan)

Czas. Stomatol.
Czasopismo Stomatologiczne (Poland)

Czech. J. Phys.
Czechoslovak Journal of Physics (Czechoslovakia)

D

Dapim Refuiin
Dapim Refuiin (Israel)

Data Process. Mag.
Data Processing Magazine (U. S.)

Dechema Monogr.
Dechema Monographien (West Germany)

Deep-Sea Res. Oceanogr. Abstr.
Deep-Sea Research and Oceanographic Abstracts (Formerly Deep-Sea Research) (England)

Defektoskopiya
Defektoskopiya (U.S.S.R.)

Del. Med. J.
Delaware Medical Journal (U.S.)

Denki Gakkai Zasshi
Denki Gakkai Zasshi (The Journal of the Institute of Electrical Engineers of Japan) (Japan)

Denki Hyoron
Denki Hyoron (Electrical Review) (Japan)

Denki Kagaku
Denki Kagaku (Journal of the Electrochemical Society of Japan) (Japan)

Denki Kyokai Zasshi
Denki Kyokai Zasshi (Journal of the Japan Electric Association) (Japan)

Denki Shikenjo Kenkyu Hokoku
Denki Shikenjo Kenkyu Hokoku (Researches of the Electrotechnical Laboratory (Japan)

Denki Shikensho Iho
Denki Shikensho Iho (Bulletin of the Electrotechnical LaboratorY (Tokyo)) (Japan)

Denki Tsushin Gakkai Zasshi
Denki Tsushin Gakkai Zasshi (The Journal of the Institution of Electrical Communication Engineers of Japan) (Japan)

Denki Tsushin Kenkyusho Kenkyu Jitsuyoka Hokoku
Denki Tsushin Kenkyusho Kenkyu Jitsuyoka Hokuku (Electrical Communication Lab., Technical Journal) (Japan)

Denpa Kenkyusho Kiho
Denpa Kenkyusho Kiho (Review of the Radio Research Laboratory) (Japan)

Denryoku Shinpo
Denryoku Shinpo (Japan)

Dent. Clin. N. Amer.
Dental Clinics of North America. (U.S.)

Dent. Dig.
Dental Digest (U.S.)

Dent. Surv.
Dental Survey (U.S.)

Dermatol. Int.
Dermatologia Internationalis (U.S.)

Dermatologica
Dermatologica (Switzerland)

Dermatol. Wochenschr.
Dermatologische Wochenschrift (East Germany)

Desalination
Desalination (Netherlands)

Des. Components Eng.
Design and Components in Engineering (England)

Des. News
Design News (U. S.)

Deut. Gesundheitsw.
Deutsche Gesundheitswesen, Das (West Germany)

Deut. Lebensm.-Rundsch.
Deutsche Lebensmittel-Rundschau (West Germany)

Deut. Med. J.
Deutsches Medizinisches Journal (West Germany)

Deut. Med. Wochenschr.
Deutsche Medizinische Wochenschrift. (West Germany)

Deut. Stomatol.
Deutsche Stomatologie (East Germany)

Deut. Textiltech.
Deutsche Textiltechnik (East Germany)

Deut. Tieraerztl. Wochenschr.
Deutsche Tierarztlich Wochenschrift (West Germany)

Deut. Zahnaertztl. Z.
Deutsche Zahnaerztliche Zeitschrift (East Germany)

Deut. Zahn-, Mund- Kieferheilk.
Deutsche Zahn-, Mund- und Kieferheilkunde mit Zentralblatt fuer die Gesamte Zahn-, Mund- und Kieferheilkunde (East Germany)

Deut. Z. Verdau.- Stoffwechselkrankh.
Deutsche Zeitschrift fuer Verdauungs-und Stoffwechselkrankheite (East Germany)

Develop. Biol.
Developmental Biology (U.S.)

Develop. Psychobiol.
Developmental Psychobiology (U. S.)

Dew Tech. Ber.
Dew Technische Berichte (West Germany)

Diabetes
Diabetes (U.S.)

Diabetologia
Diabetologia (U.S. - West Germany)

Diffus. Data
Diffusion Data (U.S.)

Dig. Int. Conf. Med. Biol. Eng.
Digest of the International Conference on Medical and Biological Engineering (Sweden)

Dis. Chest
Diseases of the Chest. (U.S.)

Discuss. Faraday Soc.
Discussions of the Faraday Society (England)

Diss. Pharm. Pharmacol.
Dissertationes Pharmaceuticae et Pharmacologicae (Poland)

XUM

DMIC Rev.
DMIC Review of Recent Developments (U.S.)

Doboku Gakkaishi
Doboku Gakkaishi (Journal of the Japan Society of Civil Engineers) (Japan)

Doboku Seko
Doboku Seko (Public Works) (Japan)

Dobutsugaku Zasshi
Dobutsugaku Zasshi (Zoological Magazine) (Japan)

Doc-Air-Espace
Doc-Air-Espace (France)
Ceased publication with No. 113, 1968

Doc. Haematol. (Bucharest)
Documenta Haematologica (Bucharest) (Romania)

Doc. Vet.
Documenta Veterinaria (Czechoslovakia)
Supersedes Vedecke Prace Vyzkumneno Ustavu Veterinarniho Lekarstvi v Brne

Dokl. Akad. Nauk Arm. SSR
Doklady Akademii Nauk Armyanskoi SSR (Armenian S.S.R.)

Dokl. Akad. Nauk Azerb. SSR
Doklady Akademii Nauk Azerbaidzhanskoi SSR (Azerbaidzhan S.S.R.)

Dokl. Akad. Nauk BSSR
Doklady Adademii Nauk BSSR (Belorussian S.S.R.)

Dokl. Akad. Nauk SSSR
Doklady Akademii Nauk SSSR (U.S.S.R.)
Issued in English Translation by Sections

Dokl. Akad. Nauk Tadzh. SSR
Doklady Akademii Nauk Tadzhikskoi SSR (Tadzhik S.S.R.)

Dokl. Akad. Nauk Uzb. SSR
Doklady Akademii Nauk Uzbekskoi SSR (Uzbek S.S.R.)

Dokl., Earth Sci. Sect. (Engl. Transl.)
Doklady, Earth Sciences Sections (English Translation) (U.S.)

Dokl. Vses. Akad. Sel'skokhoz. Nauk
Doklady Vsesoyuznoi Akademii Sel'skokhozyaistvennykh Nauk imeni V. I. Lenina (U.S.S.R.)

Dopov. Akad. Nauk Ukr. RSR, Ser. A
Dopovidi Akademii Nauk Ukrains'koi RSR, Seriya A Fiziko-Tekhnichni ta Matematichni Nauki (Supersedes in Part Dopovidi Akademii Nauk Ukrains'koi RSR) (Ukrainian S.S.R.)

Dopov. Akad. Nauk Ukr. RSR, Ser. B
Dopovidi Akademii Nauk Ukrains'koi RSR, Seriya B Geologiia, Geofizika, Khimiya na Biologiya (Supersedes In Part Dopovidi Akademii Nauk Ukrains'koi RSR) (Ukrainian S.S.R.)

Doryoku
Doryoku (Nippon Doryoku Kyokai Kaiho) (Power [Journal of the Japan Power Association)) (Japan)

Drev. Vysk.
Drevarsky Vyskum (Czechoslovakia)

Drilling
Drilling (U. S.)

Drug Intel.
Drug Intelligence (U.S.)

Duodecim
Duodecim (Finland)

E

Earth Extraterr. Sci.
Earth and Extraterrestrial Sciences (England)

Earth Planet. Sci. Lett.
Earth and Planetary Science Letters (Netherlands)

Earth-Sci. Rev.
Earth-Science Reviews (Netherlands)

Eau
Eau, L (France)
Discontinued

Ecol. Monogr.
Ecological Monographs. (U.S.)

Ecology
Ecology (U.S.)

Econ. Geol.
Economic Geology and the Bulletin of the Society of Economic Geologists (U.S.)

EEI (Edison Elec. Inst.) Bull.
EEI (Edison Electric Institute) Bulletin (U.S.)

Ehara Jiho
Ehara Jiho (Ebara Times) (Japan)

Ehime Daigaku Kiyo, Dai-3-Bu, Kogaku
Ehime Daigaku Kiyo, Dai-3-Bu, Kogaku (Memoirs of the Ehime University, Section 3, Engineering) (Japan)

Eisei Kagaku
Eisei Kagaku (The Journal of Hygienic Chemistry) (Japan)

Eisei Shikenjo Hokoku
Eisei Shikenjo Hokoku (Bulletin of National Institute of Hygenic Sciences) (Japan)

Eiyo To Shokuryo
Eiyo To Shokuryo (Journal of Japanese Society of Food and Nutrition) (Japan)

Eksp. Khir. Anesteziol.
Eksperimentalnaya Khirurgia i Anesteziologiya (U.S.S.R.)

Eksp. Med. Morfol.
Eksperimentalna Meditsina i Morfologiya (Bulgaria)

Elec. Eng. (Sydney)
Electrical Engineer (Sydney) (Australia)

Elec. Eng. Trans., Inst. Eng., Aust.
Electrical Engineering Transactions, The Institution of Engineers, Australia (Australia)

Elec. Light Power (Boston)
Electric Light and Power (Boston) (U.S.)

Elec. Rev.
Electrical Review (England)

Electricite
Electricite (Belgium)

Electrochem. Technol.
Electrochemical Technology (U.S.)
Combined with Journal of the Electrochemical Society

Electrochim. Acta
Electrochimica Acta (England)

Electrochim. Metal.
Electrochimica Metallorum (Italy)

Electron. Commun. Jap. (Engl. Transl.)
Electronics and Communications in Japan (English Translation of Denki Zusshin Gakkai Zasshi) (Japan)

Electron. Components
Electronic Components (England)

Electron. Eng.
Electronic Engineering (Formerly Electronic Engineering Incorporating Electronics, Television and Short Wave World) (England)

Electron. Equip. News
Electronic Equipment News (England)

Electron. Ind. (Paris)
Electronique Industrielle et Microelectronique (Paris) (France)

Electron. Lett.
Electronics Letters (England)

Electron. Power
Electronics and Power (England)

Electron. World
Electronics World (U.S.)

Electroplat. Metal Finish.
Electroplating and Metal Finishing (England)

Electrotechniek
Electrotechniek (Netherlands)

Electro-Technol. (N.Y.)
Electro-Technology (New York) (U.S.)

Electrotehnica (Bucharest)
Electrotehnica (Bucharest) (Romania)

Elec. World
Electrical World (U.S.)

Elek. Sta.
Elektricheskie Stantsii (U.S.S.R.)

Elektrichestvo
Elektrichestvo (U.S.S.R.)

Elektrizitaetsverwertung
Elektrizitaetsverwertung (Switzerland)

Elektrizitaetswirtschaft
Elektrizitaetswirtschaft (West Germany)

Elektrofiz. App., Sb. Statei
Elektrofizicheskaya Apparatura, Sbornik Statei (U.S.S.R.)

Elektrokhimiya
Elektrokhimiya (U.S.S.R.)

Elektromedizin
Elektromedizin und Ihre Grezgebiete (West Germany)

Elektron. Datenverarb.
Elektronische Datenverarbeitung (West Germany)

Elektron. Obrab. Mater.
Elektronnaya Obrabotka Materialov (Moldavian S.S.R.)

Elektroprivreda
Elektroprivreda (Yugoslavia)

Elektrotech. Maschinenbau
Elektrotechnik und Maschinenbau (Austria)

Elektrotech. Z., A
Elektrotechnische Zeitschrift, A (West Germany)

Elektrotech. Z., B
Elektrotechnische Zeitschrift, B (West Germany)

Elektrotekhnika
Elektrotekhnika (U.S.S.R.)

Elektrotek. Tidsskr.
Elektroteknisk Tidsskrift (Norway)

Elelmiszertudomany
Elelmiszertudomany (Hungary)

Elettrotecnica
Elettrotecnica, L' (Italy)

Emen
Emen. Journal of the University of Manchester Metallurgical Society (England)

EMO (Emergency Meas. Organ.) Dig.
EMO (Emergency Measures Organization) Digest (Canada)

Endeavour
Endeavour (England)

Endocrinol. Exp.
Endocrinologia Experimentalis (Czechoslovakia)

Endocrinol. Jap.
Endocrinologia Japonica (Japan)

Endocrinology
Endocrinology (U.S.)

Endocrinol. Sci. Cost.
Endocrinologia e Scienze della Costituzione (Italy)

Endokrinologie
Endokrinologie (East Germany)

Endokrynol. Pol.
Endokrynologia Polska (Poland)

Energ. Atomtech.
Energia es Atomtechnika (Hungary)

Energ. Elet.
Energia Elettrica (Italy)

Energetika
Energetika (Czechoslovakia)

Energie
Energie (West Germany)

Energietechnik
Energietechnik (East Germany)

Energ. Nucl. (Madrid)
Energia Nuclear (Madrid) (Spain)

Energ. Nucl. (Milan)
Energia Nucleare (Milan) (Italy)

Energ. Nucl. (Paris)
Energie Nucleaire (Paris) (France)

Energ. Tech.
Energie und Technik (West Germany)

Energy Convers.
Energy Conversion (Formerly Advanced Energy Conversion) (England)

Energy Int.
Energy International (U.S.)

Eng. Constr. World
Engineering Construction World (U. S.)

Eng. Dig. (Toronto)
Engineering Digest (Toronto) (Canada)

Engelhard Ind., Tech. Bull.
Engelhard Industries, Inc., Technical Bulletin (U.S.)

Eng. Fracture Mech.
Engineering Fracture Mechanics (England)

Eng. Geol. (Amsterdam)
Engineering Geology (Amsterdam) (Netherlands)

Engineer
Engineer, The (England)

Engineering
Engineering (England)

Eng. J. (Montreal)
Engineering Journal, The (Montreal) (Canada)

Eng., Mineracao, Met.
Engenharia, Mineracao, Metalurgia (Brazil)

Eng. Mining J.
Engineering and Mining Journal (U.S.)

Enka Biniiru To Pomria
Enka Biniiru To Pomria (Enka-Vinyl and Polymer) (Japan)

Entretiens Bichat, Stomatol.
Entretiens Bichat, Stomatologie (France)

Entropie
Entropie (France)

Environment
Environment (Formerly Scientist and Citizen) (U.S.)

Environ. Res.
Environmental Research (U.S.)

Environ. Sci. Technol.
Environmental Science and Technology (U. S.)

Enzymologia
Enzymologia (Netherlands)

Erdoel Kohle, Erdgas, Petrochem.
Erdoel und Kohle, Erdgas, Petrochemie (West Germany)

Erekutoronikusu
Erekutoronikusu (Electronics) (Japan)

Ergeb. Exakten Naturwiss.
Ergebnisse der Exakten Naturwissenschaften (West Germany)

Escher Wyss News
Escher Wyss News (Switzerland)

Essays Phys.
Essays in Physics (England)

Esso Oilways
Esso Oilways (England)

Euphytica
Euphytica. Netherlands Journal of Plant Breeding (Netherlands)

XUM

Euratom Rev.
Euratom Review of the European Atomic Energy Community (Formerly Euratom Bulletin) (Belgium)
Superseded by Euro-Spectra

Eur. J. Biochem.
European Journal of Biochemistry (Formerly Biochemische Teitschrift) (West Germany)

Eur. J. Cancer
European Journal of Cancer (England)

Eur. J. Pharmacol.
European Journal of Pharmacology (Netherlands)

Eur. Neurol.
European Neurology (Switzerland)
Supersedes Section B of Psychiatria et Neurologia

Euro-Spectra
Euro-Spectra. Scientifical and Technical Review of the European Communities (Formerly Euratom Review) (Belgium)

Eur. Polym. J.
European Polymer Journal (England)

Eur. Surg. Res.
European Surgical Research (Switzerland)

Excerpta Med. Int. Congr. Ser.
Excerpta Medica. International Congress Series (Netherlands)

Exp. Brain Res.
Experimental Brain Research (West Germany)

Exp. Cell Res.
Experimental Cell Research (U.S.)

Experientia
Experientia (Switzerland)

Exp. Eye Res.
Experimental Eye Research (England)

Exp. Gerontol.
Experimental Gerontology (U.S.)

Exp. Hematol.
Experimental Hematology (U.S.)

Exp. Med. Surg.
Experimental Medicine and Surgery. (U.S.)

Exp. Mol. Pathol.
Experimental and Molecular Pathology (U.S.)

Exp. Neurol.
Experimental Neurology. (U.S.)

Exp. Parasitol.
Experimental Parasitology. (U.S.)

Exp. Pathol.
Experimentelle Pathologie (East Germany)

Exp. Tech. Phys.
Experimentelle Technik der Physik (East Germany)

F

FAPIG (Tokyo)
FAPIG (Tokyo) (Japan)

Farmaco (Pavia) Ed. Prat.
Farmaco, Il (Pavia), Edizione Pratica. (Italy)

Farmakol. Toksikol.
Farmakologiya i Toksikologiya (U.S.S.R.)
Issued In English Translation as Pharmacology and Toxicology (USSR)

Farm. Zh.
Farmatsevtychnyi Zhurnal (Ukrainian S.S.R.)

Farumashia
Farumashia (Pharmacy) (Japan)

FEBS (Fed. Eur. Biochem. Soc.) Lett.
FEBS (Federation of European Biochemical Societies) Letters (Netherlands)

Fed. Bar J.
Federal Bar Journal (U.S.)

Fed. Proc.
Federation Proceedings (U.S.)

Ferroelectrics
Ferroelectrics (England)

Fette-Seifen-Anstrichm.
Fette-Seifen-Anstrichmittel (Combined with Ernaehrungsindustrie) (West Germany)

Fibre Sci. Technol.
Fibre Science and Technology (England)

Finommechanika
Finommechanika (Hungary)

Fish. Ind. Res.
Fishery Industrial Research (U.S.)

Fizika (Zagreb)
Fizika (Zagreb) (Yugoslavia)

Fiziol. Norm. Patol. (Bucharest)
Fiziologia Normala si Patologica (Bucharest) (Romania)

Fiziol. Zh., Akad. Nauk Ukr. RSR
Fiziologichnii Zhurnal, Akademiya Nauk Ukrainskoi RSR (Ukrainian S.S.R.)

Fiziol. Zh. SSSR
Fiziologicheskii Zhurnal SSSR imeni I. M. Sechenova (U.S.S.R.)

Fiz.-Khim. Mekh. Mater.
Fiziko-Khimicheskaya Mekhanika Materialov (Ukrainian S.S.R.)

Fiz. Khim. Obrab. Mater.
Fizika i Khimiya Obrabotki Materialov (U.S.S.R.)

Fiz.-Mat. Spis., Bulg. Akad. Nauk.
Fiziko Matematichesko Spisanie, Bulgarska Akademiya na Naukite, Fizicheski Institut, Matematicheski Institut (Bulgaria)

Fiz. Metal. Metalloved.
Fizika Metallov i Metallovedeniya, Akademiya Nauk SSSR, Ural'skii Filial (U.S.S.R.)
For English Translation see The Physics of Metals and Metallography (USSR)

Fiz. Szemle
Fizikai Szemle (Hungary)

Fiz. Tekh. Poluprov.
Fizika i Tekhnika Poluprovodnikov (U.S.S.R.)
Issued in English Translation as Soviet Physics-Semiconductors

Fla. Entomol.
Florida Entomologist, The (U.S.)

Flame Notes, Beckman
Flame Notes, Beckman (U.S.)

Fleischwirtschaft
Fleischwirtschaft, Die (West Germany)

Flora (Jena), Abt. A
Flora oder Allgemeine Botanische Zeitung (Jena), Abt. A. Physiologie und Biochemie (East Germany)

FOA (Forsvarets Forsk.) Rep.
FOA (Forsvarets Forskningsanstalt) Reports (Sweden)

Folia Biol. (Krakow)
Folia Biologica (Krakow) (Poland)

Folia Biol. (Prague)
Folia Biologica (Prague) (Czechoslovakia)

Folia Endocrinol. (Pisa)
Folia Endocrinologica (Pisa) (Italy)

Folia Endocrinol. (Rome)
Folia Endocrinologica (Rome) (Italy)

Folia Haematol. (Leipzig)
Folia Haematologia (Leipzig) (East Germany)

Folia Histochem. Cytochem. (Krakow)
Folia Histochemica et Cytochemica (Krakow) (Poland)

Folia Med. (Naples)
Folia Medica (Naples) (Italy)

Folia Med. (Plovdiv)
Folia Medica (Plovdiv) (Bulgaria)

Folia Med. Fac. Med. Univ. Saraeviensis
Folia Medica Facultatis Medicinae Universitatis Saraeviensis (Yugoslavia)

Folia Med. Neer.
Folia Medica Neerlandica (Netherlands)

Folia Microbiol. (Prague)
Folia Microbiologica (Prague) (Czechoslovakia)

Fonderie
Fonderie (France)

Food Irradiat.
Food Irradiation (France)

Food Technol.
Food Technology. (U.S.)

Food Technol. Aust.
Food Technology in Australia (Australia)

Food Technol. N. Z.
Food Technology in New Zealand (New Zealand)

Forest Prod. J.
Forest Products Journal (U.S.)

Forest Sci.
Forest Science (U.S.)

Forschungsber. Landes Nordrhein-Westfalen
Forschungsberichte des Landes Nordrhein-Westfalen (West Germany)

Forsk. Udvikling-Uddannelse (Copenhagen)
Forskning. Udvikling-Uddannelse (Copenhagen) (Formerly Ingenioren Forskning) (Denmark)
Incorporated in Ingenioerens Ugeblad

Forst Holzwirt
Forst- und Holzwirt (West Germany)

Fortn. Rev. Chicago Dent. Soc.
Fortnightly Review of the Chicago Dental Society (U.S.)

Fortschr. Chem. Forsch.
Fortschritte der Chemischen Forschung (West Germany)

Fortschr. Geb. Roentgenstr. Nuklearmed.
Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin, Diagnostik, Physik, Biologie, Therapie (West Germany)

Fortschr. Hochpolym.-Forsch.
Fortschritte der Hochpolymeren-Forschung (West Germany)

Fortschr. Med.
Fortschritte der Medizin (West Germany)

Fortschr. Phys.
Fortschritte der Physik (East Germany)

Fra Fys. Verden
Fra Fysikkens Verden (Norway)

Frankfurt. Z. Pathol.
Frankfurter Zeitschrift fuer Pathologie (West Germany)
Superseded by Virchows Archiv, B

Freiberg. Forschungsh., B
Freiberger Forschungshefte, Reihe B (East Germany)

Front. Radiat. Ther. Oncol.
Frontiers of Radiation Therapy and Oncology (Switzerland)

Fruits
Fruits (France)

Fuji Jiho
Fuji Jiho (The Fuji Electric Journal) (Japan)

Fujitsu
Fujitsu (Japan)

Fukui Daigaku Kogakubu Kenkyu Hokoku
Fukui Daigaku Kogakubu Kenkyu Hokoku (Memoirs of the Faculty of Engineering, Fukui University) (Japan)

Fukuoka Igaku Zasshi
Fukuoka Igaku Zasshi (Fukuoka Acta Medica) (Japan)

Fukuoka Kyoiku Daigaku Kiyo, Dai-3-Bu, Rika-Hen
Fukuoka Kyoiku Daigaku Kiyo, Dai-3-Bu, Rika-Hen
(Bulletin of Fukuoka University of Education, Part 3, Natural Science) (Japan)

Fune No Kagaku
Fune No Kagaku (Marine Engineering) (Japan)

Funtai Oyobi Funmatsuyakin
Funtai Oyobi Funmatsuyakin (Journal of the Japan Society of Powder and Powder Metallurgy) (Japan)

Furukawa Denko Jiho
Furukawa Denko Jiho (Furukawa Electric Review) (Japan)

Fusen
Fusen (Flotation) (Japan)

Fyz. Cas.
Fyzikalny Casopis, Vydavatel'stvo Slovenskej Akademie Vied (Czechoslovakia)

G

Gac. Med. Mex.
Gaceta Medica de Mexico (Mexico)

Gakujutsu Geppo
Gakujutsu Geppo (Japanese Scientific Monthly) (Japan)

Gamma Field Symp.
Gamma Field Symposia, Ibaraki (Japan)

Gann
Gann (Japan)

Gan No Rinsho
Gan No Rinsho (Japanese Journal of Cancer Clinics) (Japan)

Ganseki Kobutsu Kosho Gakkaishi
Ganseki Kobutsu Kosho Gakkaishi (The Journal of the Japanese Association of Mineralogists, Petrologists and Economic Geologists) (Japan)

Gastroenterology
Gastroenterology (U.S.)

Gastrointest. Endoscopy
Gastrointestinal Endoscopy (U.S.)

Gas- Wasserfach
Gas- und Wasserfach, Das (West Germany)

Gazz. Chim. Ital.
Gazzetta Chimica Italiana (Italy)

G. Bot. Ital.
Giornale Botanico Italiano (Formerly Nuovo Giornale Botanico Italiano (Nuova Serie)) (Italy)

Geburtsh. Frauenheilk.
Geburtshilfe und Frauenheilkunde (West Germany)

G.E.C.-A.E.I. J. Sci. Technol.
G.E.C.-A.E.I. Journal of Science and Technology (England)
Changed to Journal of Science and Technology (London) (England)

Gegenbaurs Morphol. Jahrb.
Gegenbaurs Morphologisches Jahrbuch (East Germany)

Gen. Comp. Endocrinol.
General and Comparative Endocrinology (U.S.)

Genen Phaenen
Genen en Phaenen (Netherlands)

Genet. Agr.
Genetica Agraria (Italy)

Genetica
Genetica (Netherlands)

Genetics
Genetics (U.S.)

Genetika
Genetika (U.S.S.R.)

Genet. Pol.
Genetica Polonica (Poland)

Genet. Res.
Genetical Research (England)

Genet. Selek.
Genetika i Selektsiya (Bulgaria)

XUM

Genet. Slechteni
Genetika a Slechteni (Czechoslovakia)

Genie Civil
Genie Civil, Le (France)

Genshikaku Kenkyu
Genshikaku Kenkyu (Nuclear Study) (Japan)

Genshiryoku Chosa Jiho
Genshiryoku Chosa Jiho (Review of Atomic Industries) (Japan)

Genshiryoku Hakusho
Genshiryoku Hakusho (Japan)

Genshiryoku Iinkai Geppo
Genshiryoku Iinkai Geppo (Journal of Atomic Energy Commission) (Japan)

Genshiryoku Kogyo
Genshiryoku Kogyo (Nuclear Engineering) (Japan)

Genshiryokusen
Genshiryokusen (Nuclear Ships) (Japan)

Geochem. Int. (Engl. Transl.)
Geochemistry International (English Translation of Selected Articles from Geokhimiya Together with Selected Translated Geochemical Papers from Other Languages) (U.S.)

Geochemistry (Nagoya)
Geochemistry (Nagoya) (Japan)

Geochem. J. (Nagoya)
Geochemical Journal (Nagoya) (Japan)

Geochim. Cosmochim. Acta
Geochimica et Cosmochimica Acta (England)

Geofis. Meteorol. (Genoa)
Geofisica e Meteorologia (Genoa) (Italy)

Geofiz. App.
Geofizicheskaya Apparatura (U.S.S.R.)

Geofiz. Kozlem.
Geofizikai Kozlemenyek (Hungary)

Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz.
Geofizicheskii Sbornik, Akademiya Nauk Ukrainskoi SSR, Institut Geofiziki (Ukrainian S.S.R.)

Geokhimiya
Geokhimiya (U.S.S.R.)
Selected Articles Appear in English Translation in Geochemistry International

Geol. Geofiz.
Geologiya i Geofizika (U.S.S.R.)

Geol. Mag.
Geological Magazine (England)

Geol. Mijnbouw
Geologie en Mijnbouw (Netherlands)

Geol. Nefti Gaza
Geologiya Nefti i Gaza (U.S.S.R.)

Geol. Soc. Amer., Bull.
Geological Society of America, Bulletin (U.S.)

Geol. Soc. Amer., Spec. Pap.
Geological Society of America, Special Paper (U.S.)

Geomagn. Aeron. (USSR) (Engl. Transl.)
Geomagnetism and Aeronomy (USSR) (English Translation of Geomagnetizm i Aeronomiya) (U.S.)

Geophysics
Geophysics (U.S.)

Geophys. J. Roy. Astron. Soc.
Geophysical Journal of The Royal Astronomical Society (England)

George Washington Law Rev.
George Washington Law Review (U.S.)

Geotechnique
Geotechnique (England)

Ger. Med. Mon.
German Medical Monthly. (West Germany)

Gesundh.-Ing.
Gesundheits-Ingenieur (West Germany)

Getreide Mehl
Getreide und Mehl (West Germany)

G. Fis. Sanit. Prot. Radiaz.
Giornale de Fisica Sanitarie e Protezione Contra le Radiazioni (Formerly a Part of Minerva Nucleare) (Italy)

Gidroaeromekhanika
Gidroaeromekhanika (Ukrainian S.S.R.)

Gidrobiol. Zh., Akad. Nauk Ukr. SSR
Gidrobiologicheskii Zhurnal, Akademiya Nauk Ukrainskoi SSR (Ukrainian S.S.R.)

Giesserei
Giesserei (West Germany)

Giessereipraxis
Giessereipraxis (West Germany)

Gifu Ika Daigaku Kiyo
Gifu Ika Daigaku Kiyo (Acta Scholae Medicinalis in Gifu) (Japan)

G. Ig. Med. Prev.
Giornale di Igiene e Medicina Preventiva (Italy)

Gig. Sanit.
Gigiena i Sanitariya (U.S.S.R.)
Issued in English Translation as Hygiene and Sanitation (USSR)

Gig. Tr. Prof. Zabol.
Gigiena Truda i Professional'nye Zabolevaniya (U.S.S.R.)

Giho (Boeicho Gijutsu Kenkyu Honbu)
Giho (Boeicho Gijutsu Kenkyu Honbu) (Research and Development Headquarters, Japan Defense Agency (Japan)

Ginecol. Obstet. Mex.
Ginecologia y Obstetricia de Mexico (Mexico)

Ginekol. Pol.
Ginekologia Polska (Poland)

G. Ital. Dermatol.
Giornale Italiano di Dermatologia (Italy)

G-I-T (Glas- Instrum.-Tech.) Fachz. Lab.
G-I-T (Glas- und Instrumenten-Technik) Fachzietschrift fuer das Laboratorium (West Germany)

G. Mal. Infet. Parassit.
Giornale di Malattie Infettive e Parassitarie (Italy)

G. Microbiol.
Giornale di Microbiologia (Italy)

God. Khim. Tekhnol. Inst.
Godishnik na Khimiko-Tekhnologicheskiya Institut (Bulgaria

God. Vissh. Tekh. Ucheb. Zaved., Fiz.
Godishnik na Visshite Tekhnicheski Uchebni Zavedeniya, Fizika (Bulgaria)

G. Psichiat. Neuropatol.
Giornale di Psichiatria e di Neuropatologia (Italy)

Great Basin Natur.
Great Basin Naturalist (U.S.)

Groenlands Geol. Unders. Rap.
Groenlands Geologiske Undersoegelse Rapport (Denmark)

Ground Water
Ground Water (U. S.)

Growth
Growth (U.S.)

Gunma J. Liberal Arts Sci.
Gunma Journal of Liberal Arts and Science (Japan)

Gunma Symp. Endocrinol.
Gunma Symposia on Endocrinology (Japan)

Gut
Gut. (British Society of Gastroenterology) (England)

Guy's Hosp. Rep.
Guy's Hospital Reports (England)

Gynaecologia
Gynaecologia (Switzerland)

H

Haematol. Lat. (Milan)
Haematologica Latina (Milan) (Italy)

Haematologia (Budapest)
Haematologia (Budapest) (Hungary)

Haematologica (Pavia)
Haematologica (Pavia) (Italy)

Haikan Gijutsu
Haikan Gijutsu (The Piping Engineering) (Japan)

Haikan To Sochi
Haikan To Sochi (Piping and Process Machinery) (Japan)

Hakko Kogaku Zasshi
Hakko Kogaku Zasshi (Journal of Fermentation Technology) (Japan)

Harvard Business Rev.
Harvard Business Review (U. S.)

Hatsuden Suiryoku
Hatsuden Suiryoku (Hydro Electric Power) (Japan)

Hautarzt
Hautarzt, Der (Austria)

Health Lab. Sci.
Health Laboratory Science (U.S.)

Health N.S.W.
Health in New South Wales (Australia)

Health Phys.
Health Physics (England)

Heat., Piping Air Cond.
Heating, Piping and Air Conditioning (U.S.)

Heat Transfer - Sov. Res.
Heat Transfer - Soviet Research (U.S.)

Helv. Chim. Acta
Helvetica Chimica Acta (Switzerland)

Helv. Chir. Acta
Helvetica Chirurgica Acta. (Switzerland)

Helv. Med. Acta
Helvetica Medica Acta. (Switzerland)

Helv. Odont. Acta
Helvetica Odontologica Acta (Switzerland)

Helv. Paediat. Acta
Helvetica Paediatrica Acta (Switzerland)

Helv. Phys. Acta
Helvetica Physica Acta (Switzerland)

Helv. Physiol. Pharmacol. Acta
Helvetica Physiologica et Pharmacologica Acta (Switzerland) Ceased publication

Henry Ford Hosp. Med. J.
Henry Ford Hospital Medical Journal (U.S.)

Hereditas
Hereditas (Sweden)

Heredity
Heredity. An International Journal of Genetics (England)

Hidroteh., Gospod. Apelor, Meteorol. (Bucharest)
Hidrotehnica, Gospodarirea Apelor, Meteorologia (Bucharest) (Romania)

Hifuka No Rinsho
Hifuka No Rinsho (Journal of Clinical Dermatology) (Japan)

High Temp. - High Pressures
High Temperatures - High Pressures. International Journal of Research (England)

High Temp. Sci.
High Temperature Science. An International Journal (U.S.)

Hihakai Kensa
Hihakai Kensa (Journal of NDI) (Japan)

Hikaku Kagaku
Hikaku Kagaku (Leather Chemistry) (Japan)

Himeji Kogyo Daigaku Kenkyu Hokoku
Himeji Kogyo Daigaku Kenkyu Hokoku (Reports of the Himeji Inst. of Technology) (Japan)

Hippokrates (Stuttgart)
Hippokrates (Stuttgart) (West Germany)

Hiradastechnika
Hiradastechnika (Hungary)

Hirosaki Daigaku Nogakubu Gakujutsu Hokoku
Hirosaki Daigaku Nogakubu Gakujutsu Hokoku (Bulletin of the Faculty of Agriculture, Hirosaki University) (Japan)

Hiroshima J. Med. Sci.
Hiroshima Journal of Medical Sciences (Japan)

Histochemie
Histochemie (West Germany)

Hitachi Hyoron
Hitachi Hyoron (The Hitachi Review) (Japan)

HNO
HNO, Wegweiser fuer die Fachaerztliche Praxis (West Germany)

Hodowla Rosl., Aklim. Nasien.
Hodowla Roslin, Aklimatyzacja i Nasiennictwo (Poland)

Hoken Butsuri
Hoken Butsuri (Journal of Japan Health Physics Society) (Japan)

Hokkaido Kaihatsu-Kyoku Doboku Shikenjo Geppo
Hokkaido Kaihatsu-Kyoku Doboku Shikenjo Geppo (Monthly Report of Civil Engineering Research Inst. of Hokkaido Development Bureau) (Japan)

Hokkaidoritsu Eisei Kenkyushoho
Hokkaidoritsu Eisei Kenkyushoho (Report of the Hokkaido Inst. of Public Health) (Japan)

Holzforschung
Holzforschung (West Germany)

Honvedorvos
Honvedorvos (Hungary)

Hopei Ts Hsueh Hsueh Pao, Tzu Jan K'o Hsueh Pan
Hopei Ts Hsueh Hsueh Pao, Tzu Jan K'o Hsueh Pan (Journal of Hopeh University, Natural Science) (China)

Horm. Metab. Res.
Hormone and Metabolic Research (West Germany)

Horumon To Rinsho
Horumon To Rinsho (Clinical Endocrinology) (Japan)

Hoshasen Kagaku, App.
Hoshasen Kagaku, Appendix (Japan)

Hospital (Rio de Janeiro)
Hospital (Rio de Janeiro) (Brazil)

Hospitals
Hospitals (U. S.)

Houille Blanche
Houille Blanche, La (France)

Hsueh Shu Yen Chiu Tzu Jan K'o Hsueh Pan
Hsueh Shu Yen Chiu Tzu Jan K'o Hsueh Pan (Scientific Research, Natural Science Edition) (China)

Hua Hsueh
Hua Hsueh (Chemistry (Taipei)) (China (Taiwan)) Ceased Publication

Humangenetik
Humangenetik (West Germany)

Hutnik (Katowice)
Hutnik (Katowice) (Poland)

Hutn. Listy
Hutnicke Listy (Czechoslovakia)

Hyogo-Kenritsu Nogyo Shikenjo Kenkyu Hokoku
Hyogo-Kenritsu Nogyo Shikenjo Kenkyu Hokoku (Bulletin of the Hyogo Prefectural Agricultural Experiment Station) (Japan)

XUM

I

Ibaraki Daigaku Kogakubu Kenkyu Shuho
Ibaraki Daigaku Kogakubu Kenkyu Shuho (Journal of the Faculty of Engineering, Ibaraki University) (Japan)

Ibaraki Daigaku Nogakubu Gakujutsu Hokoku
Ibaraki Daigaku Nogakubu Gakujutsu Hokoku (Scientific Reports of the Faculty of Agriculture, Ibaraki University) (Japan)

IBM (Int. Bus. Mach.) Syst. J.
IBM (International Business Machines) Systems Journal (U.S.)

IBM J. Res. Develop.
IBM Journal of Research and Development (U.S.)

Icarus
Icarus. International Journal of the Solar System (U.S. - England)

I Ch'uan Hsueh Chi K'an
I Ch'uan Hsueh Chi K'an (Genetica Sinica) (China)

Idaho, Univ., Agr. Exp. Sta., Curr. Inform. Ser.
Idaho, University of, Agricultural Experiment Station, Current Information Series (U.S.)

Ideggyogy. Szemle
Ideggyogyaszati Szemle (Hungary)

Idengaku Zasshi, Suppl.
Idengaku Zasshi, Supplement (Japanese Journal of Genetics, Supplement) (Japan)

Idojaras
Idojaras (Hungary)

IEEE (Inst. Elec. Electron. Eng.), J. Quant. Electron.
IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics (U.S.)

IEEE (Inst. Elec. Electron. Eng.), J. Solid-State Circuits
IEEE (Institute of Electrical and Electronics Engineers) Journal of Solid-State Circuits (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Spectrum
IEEE (Institute of Electrical and Electronics Engineers), Spectrum (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Aerospace Electron. Syst.
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Aerospace and Electronics Systems (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Antennas Propagation
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Antennas and Propagation (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Bio-Med. Eng.
IEEE (Institute of Electrical and Electronics Engineers) Transactions on Bio-Medical Engineering (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Broadcast Telev. Receivers
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Broadcast and Television Receivers (U. S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Educ.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Education (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Electron Devices
IEEE (Institute of Electric and Electronic Engineers), Transactions on Electron Devices (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Geosci. Electron.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Geoscience Electronics (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Ind. Electron. Contr. Instr.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Industrial Electronics and Control Instrumentation (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Instrum. Meas.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Instrumentation and Measurement (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Magnetics (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Microwave Theory Tech.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Microwave Theory and Techniques (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Nucl. Sci.
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Nuclear Science (Formerly IRE (Institute of Radio Engineers), Transactions on Nuclear Science) (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Power App. Syst.
IEEE (Institute of Electric and Electronic Engineers), Transactions on Power Apparatus and Systems (U.S.)

Igaku Kenkyu
Igaku Kenkyu (Acta Medica) (Fukouka) (Japan)

Igaku No Ayumi
Igaku No Ayumi (Progress in Medicine) (Japan)

Igaku To Seibutsugaku
Igaku To Seibutsugaku (Medicine and Biology) (Japan)

Igiena (Bucharest)
Igiena (Bucharest) (Romania)

Ikakikaigaku Zasshi
Ikakikaigaku Zasshi (The Journal of Japanese Medical Instruments) (Japan)

Ikushugaku Zasshi
Ikushugaku Zasshi (Japanese Journal of Breeding) (Japan)

Ill. Med. J.
Illinois Medical Journal (U. S.)

Image Dyn. Sci. Med.
Image Dynamics in Science and Medicine (U.S.)

Immunochemistry
Immunochemistry (England)

Immunology
Immunology (England)

Impact Sci. Soc.
Impact of Science on Society (France)

Ind. Aliment. (Pinerolo, Italy)
Industrie Alimentari (Pinerolo, Italy) (Italy)

Ind. At.
Industries Atomiques (France)

Ind. Ceram.
Industrie Ceramique, L' (France)

Ind. Chim. Belge
Industrie Chimique Belge (Belgium)

Ind. Conserve
Industria Conserve (Italy)

Ind. Diamond Rev.
Industrial Diamond Review (England)

Ind. Eng. Chem.
Industrial and Engineering Chemistry (U.S.)

Ind. Eng. Chem., Process Design Develop.
Industrial and Engineering Chemistry, Process Design and Development (U.S.)

Ind. Eng. Chem., Prod. Res. Develop.
Industrial and Engineering Chemistry, Product Research and Development (U.S.)

Ind. Health (Kawasaki, Jap.)
Industrial Health (Kawasaki, Japan) (Japan)

Ind. Heat.
Industrial Heating (U.S.)

Indian Concrete J.
Indian Concrete Journal (India)

Indian Farming
Indian Farming (India)

Indian Food Packer
Indian Food Packer (India)

Indian J. Appl. Chem.
Indian Journal of Applied Chemistry (India)

Indian J. Biochem.
Indian Journal of Biochemistry (India)

Indian J. Cancer
Indian Journal of Cancer (India)

Indian J. Chem.
Indian Journal of Chemistry (India)

Indian J. Exp. Biol.
Indian Journal of Experimental Biology (India)

Indian J. Genet. Plant Breed.
Indian Journal of Genetics and Plant Breeding (India)

Indian J. Med. Res.
Indian Journal of Medical Research, The (India)

Indian J. Med. Sci.
Indian Journal of Medical Sciences (India)

Indian J. Meteorol. Geophys.
Indian Journal of Meteorology and Geophysics (India)

Indian J. Phys.
Indian Journal of Physics and Proceedings of The Indian Association for the Cultivation of Science (India)

Indian J. Pure Appl. Phys.
Indian Journal of Pure and Applied Physics (India)

Indian J. Radiol.
Indian Journal of Radiology (India)

Indian J. Technol.
Indian Journal of Technology (Formerly Journal of Scientific and Industrial Research (India), Section D) (India)

Indian J. Theor. Phys.
Indian Journal of Theoretical Physics (India)

Indian Potato J.
Indian Potato Journal (India)

Indian Vet. J.
Indian Veterinary Journal, The (India)

Ind. Med. Surg.
Industrial Medicine and Surgery (U.S.)

Ind. Obst- Gemueseverwert.
Industrielle Obst- und Gemueseverwertung (West Germany)

Ind. Quim. (Buenos Aires)
Industria y Quimica (Buenos Aires) (Argentina)

Ind. Res.
Industrial Research (U.S.)

Ind. Saf.
Industrial Safety (England)

Ind. Tech.
Industries et Techniques (France)

Ind. Water Eng.
Industrial Water Engineering (U.S.)

Inform. Doc. Selec., Teh. Nucl.
Informare si Documentare Selectiva, Tehnica Nucleara (Romania)

Inform. Quim. Anal., Pura Apl. Ind.
Informacion de Quimica Analitica, Pura y Aplicada a la Industria (Spain)

Infrared Phys.
Infrared Physics. An International Research Journal (England)

Ing. Bygningsv.
Ingenioer-og Bygningsvaesen (Denmark)
Superseded by Ingenioer-Magasinet

Ing. Nucl.
Ingegneria Nucleare (Italy)

Ing. Sanit.
Ingegneria Sanitaria (Italy)

Inorg. Chem.
Inorganic Chemistry (U.S.)

Inorg. Chim. Acta
Inorganica Chimica Acta (Italy)

Inorg. Nucl. Chem. Lett.
Inorganic and Nuclear Chemistry Letters (England-U.S.)

Inst. Mining Met., Trans./Sect. B
Institution of Mining and Metallurgy, Transactions/Section B. Applied Earth Science (Continues in Part Transactions of the Institution of Mining and Metallurgy) (England)

Inst. Radio Electron. Eng., Aust., Proc.
Institution of Radio and Electronics Engineers, Australia, Proceedings (Australia)

Instrum. Contr. Syst.
Instruments and Control Systems (U.S.)

Instrum. Pract.
Instrument Practice. Control Systems, Electronics, Automation (England)

Inst. Space Aeronaut. Sci., Univ. Tokyo, Rep.
Institute of Space and Aeronautical Science, University of Tokyo, Report (Japan)

Int. Arch. Allergy Appl. Immunol.
International Archives of Allergy and Applied Immunology (Switzerland)

Int. Arch. Gewerbepathol. Gewerbehyg.
Internationales Archiv fuer Gewerbepathologie und Gewerbehygiene (West Germany)

Int. Astron. Union Symp.
International Astronomical Union Symposium (Netherlands)

Int. At. Energy Agency Bull.
International Atomic Energy Agency Bulletin (Austria)

Int. Elektron. Rundsch.
Internationale Elektronische Rundschau (Germany)

Inter Electron.
Inter Electronique (France)

Internist
Internist, Der (West Germany)

Int. Geol. Rev.
International Geology Review (U.S.)

Int. J. Appl. Radiat. Isotop.
International Journal of Applied Radiation and Isotopes (England)

Int. J. Cancer
International Journal of Cancer (Denmark)

Int. J. Chem. Kinet.
International Journal of Chemical Kinetics (U. S.)

Int. J. Elec. Eng. Educ.
International Journal of Electrical Engineering Education (England)

Int. J. Electron.
International Journal of Electronics (Formerly Journal of Electronics and Control) (England)

Int. J. Eng. Sci.
International Journal of Engineering Science (England)

Int. J. Fert.
International Journal of Fertility (U.S.)

Int. J. Fracture Mech.
International Journal of Fracture Mechanics (Netherlands)

Int. J. Heat Mass Transfer
International Journal of Heat and Mass Transfer (England)

Int. J. Leprosy
International Journal of Leprosy (U.S.)

Int. J. Nondestruc. Test.
International Journal of Nondestructive Testing (U.S.)

Int. J. Powder Met.
International Journal of Powder Metallurgy (U.S.)

Int. J. Quant. Chem.
International Journal of Quantum Chemistry (U.S.)

Int. J. Quant. Chem., Symp.
International Journal of Quantum Chemistry, Symposium (U.S.)

Int. J. Radiat. Biol.
International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine (England)

Int. J. Radiat. Phys. Chem.
International Journal for Radiation Physics and Chemistry (England)

Int. J. Rock Mech. Mining Sci.
International Journal of Rock Mechanics and Mining Sciences (U.S. - England)

Int. Nurs. Rev.
International Nursing Review (England)

Int. Rev. Connect. Tissue Res.
International Review of Connective Tissue Research (U.S.)

Int. Ser. Monogr. Anal. Chem.
International Series of Monographs in Analytical Chemistry (U. S. - Scotland)

Int. Shipbuild. Progr.
International Shipbuilding Progress (Netherlands)

Int. Surg.
International Surgery (U.S.)

Int. Z. Angew. Physiol.
Internationale Zeitschrift fuer Angewandte Physiologie Einschlicsslich Arbeitsphysiologie (West Germany)

Int. Z. Vitaminforsch.
Internationale Zeitschrift fuer Vitaminforschung (Switzerland)

Invest. Ophthalmol.
Investigative Ophthalmology (U.S.)

Invest. Radiol.
Investigative Radiology (U.S.)

Invest. Urol.
Investigative Urology (U. S.)

Inz. Budownictwo
Inzynieria i Budownictwo (Poland)

Inzh.-Fiz. Zh.
Inzhenerno-Fizicheskii Zhurnal (Formerly Inzhenerno-Fizicheskii Zhurnal, Akademii Nauk Belorusskoi SSR) (Belorussian S.S.R.)

Iowa Dent. J.
Iowa Dental Journal (U. S.)

Iron Age
Iron Age (U.S.)

Iron Age Metalwork. Int.
Iron Age Metalworking International (U.S.)

Iron Steel (London)
Iron and Steel (London) (England)

IRT (Int. Res. Technol.) Nucl. J.
IR and T (International Research and Technology Corporation) Nuclear Journal (U.S.)

Iryo
Iryo (Medical Treatment) (Japan)

ISA (Instrum. Soc. Amer.), Proc., Int. Power Instrum. Symp.
ISA (Instrument Society of America), Proceedings, International Power Instrumentation Symposium (U.S.)

ISA (Instrum. Soc. Amer.), Proc., Nat. Aerosp. Instrum. Symp.
ISA (Instrument Society of America), Proceedings, National Aerospace Instrumentation Symposium (U.S.)

ISA (Instrum. Soc. Amer.) Trans.
ISA (Instrument Society of America) Transactions (U.S.)

Ishikawajima-Harima Giho
Ishikawajima-Harima Giho (Ishikawajima-Harima Engineering Review) (Japan)

Isotopenpraxis
Isotopenpraxis (East Germany)

Isotope Radiat. Res.
Isotope and Radiation Research (Egypt)

Isotop. Radiat. Technol.
Isotopes and Radiation Technology (A Quarterly Technical Progress Review) (U.S.)

Israel J. Chem.
Israel Journal of Chemistry (Supersedes Bulletin of the Research Council of Israel, Section A Chemistry) (Israel)

Israel J. Earth-Sci.
Israel Journal of Earth-Sciences (Israel)

Israel J. Med. Sci.
Israel Journal of Medical Sciences (Israel)

Israel J. Technol.
Israel Journal of Technology (Israel)

Issled. Genet.
Issledovaniya po Genetike (U.S.S.R.)

Istanbul Univ. Fen Fak. Mecm., Seri C
Istanbul Universitesi fen Faultesi Mecmuasi, Seri C Astronomi-Fizik (Turkey)

Iugoslav. Physiol. Pharmacol. Acta
Iugoslavica Physiologica et Pharmacologica Acta (Yugoslavia)

Iyo Denshi To Seitai Kogaku
Iyo Denshi To Seitai Kogaku (Nippon M-E Gakkai Zasshi) (Japanese Journal of Medical Electronics and Biological Engineering) (Japan)

Izmer. Tekh.
Izmeritel'naya Tekhnika (U.S.S.R.)
For English Translation see Measurement Techniques (USSR)

Izobret., Prom. Obraztsy, Tovarnye Znaki
Izobreteniya, Promyshlennye Obraztsy, Tovarnye Znaki (U.S.S.R.)

Izv. Akad. Nauk Arm. SSR, Nauki Zemle
Izvestiya Akademii Nauk Armyanskoi SSR, Nauki o Zemle (Armenian S.S.R.)

Izv. Akad. Nauk Arm. SSR, Ser. Fiz.
Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Fizika (Formerly part of Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Fiziko-Matematicheskikh Nauk) (Armenian S.S.R.)

Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk
Izvestiya Akademii Nauk Azerbaidzhanskoi SSR, Seriya Fiziko-Tekhnicheskikh i Matematicheskikh Nauk (Azerbaidzhan S.S.R.)

Izv. Akad. Nauk Est. SSR, Biol.
Izvestiya Akademii Nauk Estonskoi SSR, Biologiya (Formerly Izvestiya Akademii Nauk Estonskoi SSR, Seriya Biologicheskaya) (Estonian S.S.R.)

Izv. Akad. Nauk Est. SSR, Fiz. Mat.
Izvestiya Akademii Nauk Estonskoi SSR, Fizika Matematika (Estonian S.S.R.) (Formerly a Part of Izvestiya Akademii Nauk Estonskoi SSR, Seriya Fiziko-Matematicheskikh i Tekhnicheskikh Nauk) (Estonian S.S.R.)

Izv. Akad. Nauk Est. SSR, Ser. Biol.
Izvestiya Akademii Nauk Estonskoi SSR, Seriya Biologicheskaya (Estonian S.S.R.)
Superseded by Izv. Akad. Nauk Est. SSR, Biol.

Izv. Akad. Nauk Kaz. SSR, Ser. Biol.
Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Biologicheskaya (Formerly Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Biologicheskikh Nauk) (Kazakh S.S.R.)

Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.
Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Fiziko-Matematicheskaya (Formerly Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Fiziko-Matematicheskikh Nauk) (Kazakh S.S.R.)

Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat. Nauk
Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Fiziko-Matematicheskikh Nauk (Kazakh S.S.R.)
Superseded by Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Fiziko-Matematicheskaya

Izv. Akad. Nauk Kaz. SSR, Ser. Khim.
Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Khimicheskaya (Kazakh S.S.R.)

Izv. Akad. Nauk SSSR, Energ. Transp.
Izvestiya Akademii Nauk SSSR, Energetika i Transport (U.S.S.R.)

Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana
Izvestiya Akademii Nauk SSSR, Fizika Atmosfery i Okeana (U.S.S.R.)

Izv. Akad. Nauk SSSR, Fiz. Zemli
Izvestiya Akademii Nauk SSSR, Fizika Zemli (U.S.S.R.)

Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza
Izvestiya Akademii Nauk SSSR, Mekhanika Zhidkosti i Gaza (U.S.S.R.)
Issued in English Translation as Soviet Fluid Mechanics

Izv. Akad. Nauk SSSR, Metal.
Izvestiya Akademiya Nauk SSSR, Metally (Formerly Izvestiya Akademiya Nauk SSSR, Metallurgiya, Gornoe Delo) (U.S.S.R.)
Issued in English Translation as Russian Metallurgy

Izv. Akad. Nauk SSSR, Neorg. Mater.
Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy (U.S.S.R.)
Issued in English Translation as Inorganic Materials (USSR)

Izv. Akad. Nauk SSSR, Ser. Biol.
Izvestiya Akademii Nauk SSSR, Seriya Biologicheskaya (U.S.S.R.)

Izv. Akad. Nauk SSSR, Ser. Fiz.
Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya (U.S.S.R.)

Izv. Akad. Nauk SSSR, Ser. Khim.
Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya (U.S.S.R.)

Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk
Izvestiya Akademii Nauk Uzbekskoi SSR, Seriya Fiziko-Matematicheskikh Nauk (Uzbek S.S.R.)

Izv. Fiz. Inst. Aneb, Bulg. Akad. Nauk.
Izvestiya na Fizicheskiya Institut s Aneb, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Geofiz. Inst., Bulg. Akad. Nauk.
Izvestiya na Geofizichniya Institut, Bulgarska Akademiya na Naukite, Otdelenie a Matematicheski i Fizicheski Nauki (Bulgaria)

Izv. Geol. Inst., Bulg. Akad. Nauk., Ser. Geokhim., Mineral. Petrogr.
Izvestiya na Geologicheskiya Institut, Bulgarska Akademiya na Naukite, Seriya Geokhimiya, Mineralogiya i Petrografiya (Bulgaria)

Izv. Inst. Elektron., Bulg. Akad. Nauk.
Izvestiya na Instituta po Elektronika, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Inst. Morfol., Bulg. Akad. Nauk.
Izvestiya na Instituta po Morfologiya, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Krym. Astrofiz. Observ.
Izvestiya Krymskoi Astrofizicheskoi Observatorii (U.S.S.R.)

Izv. Sekts. Astron., Bulg. Akad. Nauk.
Izvestiya na Sektsiyata po Astronomiya, Bulgarska Akademiya na Naukite (Bulgaria)

Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk
Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Khimicheskikh Nauk (U.S.S.R.)
Issued in English Translations as Siberian Chemistry Journal

Izv. Timiryazev. Sel'skokhoz. Akad.
Izvestiya Timiryazevskoi Sel'skokhozyaistvennoi Akademii (U.S.S.R.)

Izv. Tomsk. Politekh. Inst.
Izvestiya Tomskogo Politekhnicheskogo Instituta imeni S. M. Kirova (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh.
Izvestiya Vysshikh Uchebnykh Zavedenii, Aviatsionnaya Tekhnika (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Chern. Met.
Izvestiya Vysshikh Uchebnykh Zavedenii, Chernaya Metallurgiya (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Elektromekh.
Izvestiya Vysshikh Uchebnikh Zavedenii, Elektromekhanika (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Energ.
Izvestiya Vysshikh Uchebnykh Zavedenii, Energetika (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Fiz.
Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika (U.S.S.R.)
Issued in English translation as Soviet Physics Journal

Izv. Vyssh. Ucheb. Zaved., Geol. Razved.
Izvestiya Vysshikh Uchebnykh Zavedenii, Geologiya i Razvedka (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.
Izvestiya Vysshikh Uchebnykh Zavedenii, Khimiya i Khimicheskaya Tekhnologiya (U.S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Radioelektron.
Izvestiya Vysshikh Uchebnykh Zavedenii, Radioelektronika (Ukrainian S.S.R.)

Izv. Vyssh. Ucheb. Zaved., Radiofiz.
Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika (U.S.S.R.)
Issued in English Translation as Soviet Radiophysics

Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.
Izvestiya Vysshikh Uchebnykh Zavedenii, Tsvetnaya Metallurgiya (U.S.S.R.)

J

J. Acoust. Soc. Amer.
Journal of the Acoustical Society of America (U.S.)

Jad. Energ.
Jaderna Energie (Czechoslovakia)

J. Agr. Food Chem.
Journal of Agricultural and Food Chemistry (U.S.)

J. Agr. Sci.
Journal of Agricultural Science, The (England)

J. Agr. Univ. Puerto Rico
Journal of Agriculture of the University of Puerto Rico, The (Puerto Rico)

J. Air Law Commer.
Journal of Air Law and Commerce (U. S.)

J. Air Pollut. Contr. Ass.
Journal of the Air Pollution Control Association (U.S.)

J. Amer. Ceram. Soc.
Journal of The American Ceramic Society (U.S.)

J. Amer. Chem. Soc.
Journal of The American Chemical Society (U.S.)

J. Amer. Coll. Health Ass.
Journal of the American College Health Association (U. S.)

J. Amer. Dent. Ass.
Journal of The American Dental Association, The (U.S.)

J. Amer. Diet. Ass.
Journal of The American Dietetic Association (U.S.)

J. Amer. Geriat. Soc.
Journal of The American Geriatrics Society (U.S.)

J. Amer. Med. Ass.
Journal of The American Medical Association (U.S.)

J. Amer. Oil Chem. Soc.
Journal of The American Oil Chemists Society, The (U.S.)

J. Amer. Osteopath. Ass.
Journal of The American Osteopathic Association, The (U.S.)

J. Amer. Soc. Hort. Sci.
Journal of the American Society for Horticultural Science (U. S.)
Supersedes Proceedings of the American Society for Horticultural Science

J. Amer. Soc. Safety Eng.
Journal of the American Society of Safety Engineers (U.S.)

J. Amer. Vet. Med. Ass.
Journal of The American Veterinary Medical Association, The (U.S.)

J. Amer. Water Works Ass.
Journal of The American Water Works Association (U.S.)

J. Anim. Morphol. Physiol.
Journal of Animal Morphology and Physiology (India)

J. Anim. Sci.
Journal of Animal Science (U.S.)

J. Annamalai Univ., Part B
Journal of the Annamalai University, Part B (India)

Jap. Anal.
Japan Analyst (Bunseki Kagaku) (Japan)

Jap. Circ. J. (Engl. Ed.)
Japanese Circulation Journal (English Edition) (Japan)

XUM

Jap. J. Appl. Phys.
Japanese Journal of Applied Physics (Japan)

Jap. J. Clin. Radiol.
Japanese Journal of Clinical Radiology (Japan)

Jap. J. Exp. Med.
Japanese Journal of Experimental Medicine, The (Japan)

Jap. J. Genet.
Japanese Journal of Genetics (Idengaku Zasshi) (Japan)

Jap. J. Math.
Japanese Journal of Mathematics (Japan)

Jap. J. Med.
Japanese Journal of Medicine (Japan)

Jap. J. Med. Sci. Biol.
Japanese Journal of Medical Science and Biology (Japan)

Jap. J. Microbiol.
Japanese Journal of Microbiology (Japan)

Jap. J. Pharmacol.
Japanese Journal of Pharmacology, The (Japan)

Jap. J. Zool.
Japanese Journal of Zoology (Japan)

Jap. Nucl. Med.
Japanese Nuclear Medicine (Japan)

J. Appl. Bacteriol.
Journal of Applied Bacteriology (England)

J. Appl. Chem. (London)
Journal of Applied Chemistry (London) (England)

J. Appl. Crystallogr.
Journal of Applied Crystallography (Denmark)

J. Appl. Ecol.
Journal of Applied Ecology (England)

J. Appl. Meteorol.
Journal of Applied Meteorology (U.S.)

J. Appl. Phys.
Journal of Applied Physics (U.S.)

J. Appl. Physiol.
Journal of Applied Physiology (U.S.)

J. Appl. Polym. Sci.
Journal of Applied Polymer Science (U.S.)

J. Arkansas Med. Soc.
Journal of The Arkansas Medical Society, The (U.S.)

J. Ass. Offic. Anal. Chem.
Journal of the Association of Official Analytical Chemists (Formerly Journal of the Association of Official Agricultural Chemists) (U.S.)

J. Ass. Physicians India
Journal of The Association of The Physicians of India (India)

J. Asthma Res.
Journal of Asthma Research (U.S.)

J. Atheroscler. Res.
Journal of Atherosclerosis Research (Netherlands)

J. Atmos. Sci.
Journal of The Atmospheric Sciences (Formerly the Journal of Meteorology) (U.S.)

J. Atmos. Terrest. Phys.
Journal of Atmospheric and Terrestrial Physics (Northern Ireland)

J. Aust. Ceram. Soc.
Journal of the Australian Ceramic Society (Australia)

J. Aust. Inst. Metals
Journal of the Australian Institute of Metals (Australia)

J. Aust. Math. Soc.
Journal of the Australian Mathematical Society (Australia)

J. Bacteriol.
Journal of Bacteriology (U.S.)

J. Basic Eng.
Journal of Basic Engineering, Transactions of The ASME, Series D (U.S.)

J. Belge Radiol.
Journal Belge de Radiologie (Belgium)

J. Biochem. (Tokyo).
Journal of Biochemistry, The (Tokyo) (Japan)

J. Biol. Chem.
Journal of Biological Chemistry, The (U.S.)

J. Biol. Med. Nucl.
Journal de Biologie et de Medecine Nucleaires. Supplement au Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire) (France)

J. Biol. Photogr. Ass.
Journal of the Biological Photographic Association, The (U.S.)

J. Biomed. Mater. Res.
Journal of Biomedical Materials Research (U.S.)

J. Bone Joint Surg.
Journal of Bone and Joint Surgery, The (England)

J. Brit. Interplanet. Soc.
Journal of the British Interplanetary Society (England)

J. Brit. Nucl. Energy Soc.
Journal of the British Nuclear Energy Society, The (Formerly Journal of the British Nuclear Energy Conference) (England)

J. Calif. State Dent. Ass.
Journal of the California State Dental Association, The (U.S.)

J. Can. Ass. Radiol.
Journal of the Canadian Association of Radiologists (Canada)

J. Can. Dent. Ass.
Journal of the Canadian Dental Association, The (Canada)

J. Cardiovasc. Surg.
Journal of Cardiovascular Surgery (Italy)

J. Catal.
Journal of Catalysis (U.S.)

J. Cell Biol.
Journal of Cell Biology, The (Formerly Journal of Biophysical and Biochemical Cytology) (U.S.)

J. Cell. Physiol.
Journal of Cellular Physiology (Formerly Journal of Cellular and Comparative Physiology) (U.S.)

J. Chem. Educ.
Journal of Chemical Education (U.S.)

J. Chem. Eng. Data
Journal of Chemical and Engineering Data (U.S.)

J. Chem. Phys.
Journal of Chemical Physics, The (U.S.)

J. Chem. Soc., A
Journal of the Chemical Society (London), A. Inorganic Physical Theoretical (Formerly a Part of Journal of the Chemical Society (London)) (England)

J. Chem. Soc., B
Journal of The Chemical Society (London), B. Physical Organic (Formerly a Part of Journal of The Chemical Society (London)) (England)

J. Chem. Soc., C
Journal of the Chemical Society (London), C. Organic (Formerly a Part of Journal of the Chemical Society (London)) (England)

J. Chem. Soc., D
Journal of the Chemical Society, D (Formerly Chemical Communications) (England)

J. Chem. Thermodyn.
Journal of Chemical Thermodynamics, The (England - U.S.)

J. Chim. Phys.
Journal de Chimie Physique et de Physico-Chimie Biologique (France)

J. Chin. Chem. Soc. (Taiwan)
Journal of the Chinese Chemical Society (Taiwan) (China)

J. Chir. (Paris)
Journal de Chirurgie (Paris) (France)

J. Chromatogr.
Journal of Chromatography (Netherlands)

J. Clin. Endocrinol. Metab.
Journal of Clinical Endocrinology and Metabolism, The (U.S.)

J. Clin. Invest.
Journal of Clinical Investigation, The (U.S.)

J. Clin. Pathol.
Journal of Clinical Pathology. (England)

J. Colloid Interface Sci.
Journal of Colloid and Interface Science (Formerly Journal of Colloid Science) (U.S.)

J. Colo. Dent. Ass.
Journal of the Colorado Dental Association (U. S.)

J. Comb. Theory
Journal of Combinatorial Theory (U.S. - England)

J. Compos. Mater.
Journal of Composite Materials (U.S.)

J. Comp. Physiol. Psychol.
Journal of Comparative and Physiological Psychology. (U.S.)

J. Comput. Phys.
Journal of Computational Physics (U.S.)

J. Cons. Perma. Int. Explor. Mer
Journal du Conseil, Conseil Permanent International pour l'Exploration de la Mer (Denmark)

J. Cryst. Growth
Journal of Crystal Growth (Netherlands)

J. Dairy Sci.
Journal of Dairy Science (U.S.)

J. Dent. Ass. S. Afr.
Journal of the Dental Association of South Africa (South Africa)

J. Dent. Educ.
Journal of Dental Education (U.S.)

J. Dent. Res.
Journal of Dental Research, The (U.S.)

J. Econ. Entomol.
Journal of Economic Entomology (U.S.)

J. Electroanal. Chem.
Journal of Electroanalytical Chemistry (Netherlands)
Superseded by J. Electroanal. Chem. Interfacial Electrochem.

J. Electroanal. Chem. Interfacial Electrochem.
Journal of Electroanalytical Chemistry and Interfacial Electrochemistry (Formerly Journal of Electroanalytical Chemistry) (Netherlands)

J. Electrochem. Soc.
Journal of the Electrochemical Society (U.S.)

J. Electrochem. Soc. India
Journal of the Electrochemical Society of India (India)

J. Electron Microsc. (Tokyo)
Journal of Electron Microscopy (Tokyo) (Japan)

J. Embryol. Exp. Morphol.
Journal of Embryology and Experimental Morphology (England)

Jena Rev.
Jena Review (East Germany)

J. Endocrinol.
Journal of Endocrinology, The (England)

J. Eng. Ind.
Journal of Engineering for Industry. Transactions of the ASME (American Society of Mechanical Engineers), Series B (U.S.)

J. Eng. Math.
Journal of Engineering Mathematics (Netherlands)

J. Eng. Mech. Div., Amer. Soc. Civil Eng.
Journal of the Engineering Mechanics Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Eng. Power
Journal of Engineering for Power, Transactions of the ASME (American Society of Mechanical Engineers), Series A (U.S.)

J. Environ. Sci.
Journal of Environmental Sciences (U. S.)

Jernkontorets Ann.
Jernkontorets Annaler (Sweden)

JETP Lett. (USSR) (Engl. Transl.)
JETP Letters (USSR) (English Translation of Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Pisma v Redaktsiyu) (U.S.)

J. Exp. Biol.
Journal of Experimental Biology, The (England)

J. Exp. Bot.
Journal of Experimental Botany. (England)

J. Exp. Mar. Biol. Ecol.
Journal of Experimental Marine Biology and Ecology (Netherlands)

J. Exp. Med.
Journal of Experimental Medicine (U.S.)

J. Exp. Zool.
Journal of Experimental Zoology. (U.S.)

J. Fac. Eng., Univ. Tokyo, Ser. B
Journal of the Faculty of Engineering, University of Tokyo, Series B (Japan)

J. Fish. Res. Board Can.
Journal of the Fisheries Research Board of Canada (Canada)

J. Fluid Mech.
Journal of Fluid Mechanics (England)

J. Food Sci.
Journal of Food Science. (U.S.)

J. Forensic Sci. Soc.
Journal of the Forensic Science Society (England)

J. Franklin Inst.
Journal of the Franklin Institute (U.S.)

J. Fr. Oto-Rhino-Laryngol.
Journal Francais d'Oto-Rhino-Laryngologie et Chirurgie Maxillo-Faciale (France)

J. Fuel Heat. Technol.
Journal of Fuel and Heating Technology (England)

J. Ga. Dent. Ass.
Journal of the Georgia Dental Association (U.S.)

J. Genet. Psychol.
Journal of Genetic Psychology Child Behavior, Animal Behavior and Problems of Aging (U.S.)

J. Gen. Microbiol.
Journal of General Microbiology, The (England)

J. Gen. Physiol.
Journal of General Physiology, The (U.S.)

J. Gen. Virol.
Journal of General Virology (England)

J. Geol. Soc. Aust.
Journal of the Geological Society of Australia (Australia)

J. Geomagnet. Geoelec.
Journal of Geomagnetism and Geoelectricity (Japan)

J. Geophys. Res.
Journal of Geophysical Research (U.S.)

J. Gerontol.
Journal of Gerontology (U.S.)

J. Glaciol.
Journal of Glaciology (England)

J. Heat Transfer
Journal of Heat Transfer, Transactions of the ASME (American Society of Mechanical Engineers), Series C (U.S.)

J. Hered.
Journal of Heredity, The (U.S.)

J. Histochem. Cytochem.
Journal of Histochemistry and Cytochemistry, The (U.S.)

J. Hydrol.
Journal of Hydrology (Netherlands)

J. Hyg.
Journal of Hygiene, The (U.S.)

J. Hyg., Epidemiol., Microbiol., Immunol.
Journal of Hygiene, Epidemiology, Microbiology, and Immunology (Czechoslovakia)

Jibi Inkoka Rinsho
Jibi Inkoka Rinsho (Practica Otologica) (Japan)

Jibi To Rinsho
Jibi To Rinsho (Otologia Fukuoka) (Japan)

Jikeikai Med. J.
Jikeikai Medical Journal (Japan)

Jikken Keitaigakushi
Jikken Keitaigakushi (Japanese Journal of Experimental Morphology) (Japan)

J. Immunol.
Journal of Immunology (U.S.)

J. Indiana State Med. Ass.
Journal of Indiana State Medical Association (U.S.)

J. Indian Bot. Soc.
Journal of the Indian Botanical Society (India)

J. Indian Dent. Ass.
Journal of the Indian Dental Association (India)

J. Indian Inst. Sci.
Journal of the Indian Institute of Science (India)

J. Indian Med. Ass.
Journal of the Indian Medical Association (India)

J. Infect. Dis.
Journal of Infectious Diseases, The (U.S.)

J. Inorg. Nucl. Chem.
Journal of Inorganic and Nuclear Chemistry (England)

Jinrui Idengaku Zasshi
Jinrui Idengaku Zasshi (The Japanese Journal of Human Genetics) (Japan)

J. Insect Physiol.
Journal of Insect Physiology (U. S.)

J. Inst. Chem. (India)
Journal of the Institution of Chemists (India) (India)
Supersedes Journal and Proceedings of the Institution of Chemists (India)

J. Inst. Eng., Aust.
Journal of the Institution of Engineers, Australia (Australia

J. Inst. Eng. (India)
Journal of the Institution of Engineers (India) (India)

J. Inst. Eng. (India), Elec. Eng. Div.
Journal of the Institution of Engineers (India), Electrical Engineering Division (India)

J. Inst. Eng. (India), Public Health Eng. Div.
Journal of the Institution of Engineers (India), Public Health Engineering Division (India)

J. Inst. Math. Appl.
Journal of the Institute of Mathematics and Its Applications (England)

J. Inst. Metals
Journal of the Institute of Metals with Bulletin and Metallurgical Abstracts (England)

J. Inst. Telecommun. Eng.
Journal of the Institution of Telecommunication Engineers (India)

J. Inst. Wood Sci.
Journal of the Institute of Wood Science (England)

J. Invertebr. Pathol.
Journal of Invertebrate Pathology (U.S.)

J. Invest. Dermatol.
Journal of Investigative Dermatology, The (U.S.)

J. Iron Steel Inst. (London)
Journal of the Iron and Steel Institute (London). (England)

J. Jap. Inst. Metals
Journal of the Japan Institute of Metals (Nippon Kinzoku) Gakkaishi) (Japan)

J. Jap. Water Works Ass.
Journal of Japan Water Works Association (Japan)

J. Kans. Med. Soc.
Journal of the Kansas Medical Society, The (U.S.)

J. Korean Inst. Metals
Journal of the Korean Institute of Metals (South Korea)

J. Korean Nucl. Soc.
Journal of the Korean Nuclear Society (South Korea)

J. Korean Phys. Soc.
Journal of the Korean Physical Society (South Korea)

J. Lab. Clin. Med.
Journal of Laboratory and Clinical Medicine, The (U.S.)

J. Laryngol. Otol.
Journal of Laryngology and Otology, The (England)

J. La. State Med. Soc.
Journal of the Louisiana State Medical Society (U.S.)

J. Less-Common Metals
Journal of the Less-Common Metals (Netherlands)

J. Low Temp. Phys.
Journal of Low Temperature Physics (U.S.)

J. Lubric. Technol.
Journal of Lubrication Technology, Transactions of the ASME (American Society of Mechanical Engineers), Series F (U.S.)

J. Macromol. Sci., Part A
Journal of Macromolecular Science, Part A: Chemistry (Supersedes Journal of Macromolecular Chemistry) (U.S.)

J. Magn. Resonance
Journal of Magnetic Resonance (England)

J. Mar. Biol. Ass. U.K.
Journal of the Marine Biological Association of The United Kingdom (England)

J. Mass. Dent. Soc.
Journal of the Massachusetts Dental Society (U. S.)

J. Mass Spectrom. Ion Phys.
Journal of Mass Spectrometry and Ion Physics (Netherlands)

J. Mater.
Journal of Materials (U.S.)

J. Mater. Sci.
Journal of Materials Science (England)

J. Mater. Sci. Soc. Jap.
Journal of the Materials Science Society of Japan (Japan)

J. Math. Anal. Appl.
Journal of Mathematical Analysis and Applications (U.S.)

J. Math. Mech.
Journal of Mathematics and Mechanics (U.S.)

J. Math. Phys. (N.Y.)
Journal of Mathematical Physics (New York) (U.S.)

J. Math. Phys. Sci.
Journal of Mathematical and Physical Science (India)

J. Md. State Dent. Ass.
Journal of the Maryland State Dental Association (U.S.)

J. Mec.
Journal de Mecanique (France)

J. Mech. Eng. Sci.
Journal of Mechanical Engineering Science, The (England)

J. Med. Bordeaux
Journal de Medecine de Bordeaux (France)

J. Med. Chem.
Journal of Medicinal Chemistry (U.S.)

J. Med. Entomol.
Journal of Medical Entomology (U.S.)

J. Med. Lab. Technol.
Journal of Medical Laboratory Technology (England)

J. Med. Soc. N. J.
Journal of the Medical Society of New Jersey (U.S.)

J. Metals
Journal of Metals (U.S.)

J. Meteorol. Res.
Journal of Meteorological Research (Kisocho Kenkyu Jiho) (Japan)

J. Mich. State Dent. Ass.
Journal of the Michigan State Dental Association (U.S.)

J. Microscop.
Journal de Microscopie (France)

J. Microwave Power
Journal of Microwave Power (Canada)

J. Mines, Metals Fuels
Journal of Mines, Metals and Fuels (India)

J. Mol. Biol.
Journal of Molecular Biology (U.S.)

J. Mol. Spectrosc.
Journal of Molecular Spectroscopy (U.S.)

J. Mol. Struct.
Journal of Molecular Structure (Netherlands)

J. Morphol.
Journal of Morphology (U.S.)

J. Mt. Sinai Hosp., N.Y.
Journal of the Mount Sinai Hospital, New York (U.S.)

J. Nat. Cancer Inst.
Journal of the National Cancer Institute (U.S.)

J. Natur. Sci. Math.
Journal of Natural Sciences and Mathematics (Pakistan)

J. Neurochem.
Journal of Neurochemistry (England)

J. Neurol., Neurosurg., Psychiat.
Journal of Neurology, Neurosurgery, and Psychiatry (England)

J. Neurol. Sci.
Journal of the Neurological Sciences (Netherlands)

J. Neuropathol. Exp. Neurol.
Journal of Neuropathology and Experimental Neurology, The (U.S.)

J. Neurosurg.
Journal of Neurosurgery (U.S.)

J. N. J. State Dent. Soc.
Journal of the New Jersey State Dental Society, The (U.S.)

J. Nucl. Biol. Med.
Journal of Nuclear Biology and Medicine (Supersedes in Part Minerva Nucleare) (Italy)

J. Nucl. Energy
Journal of Nuclear Energy (Formerly Journal of Nuclear Energy, Parts A and B, Reactor Science and Technology) (England)

J. Nucl. Mater.
Journal of Nuclear Materials (Journal des Materiaux Nucleaires) (Netherlands)

J. Nucl. Med.
Journal of Nuclear Medicine (U.S.)

J. Nucl. Med., Suppl.
Journal of Nuclear Medicine, Supplement (U.S.)

J. Nucl. Sci. (Seoul)
Journal of Nuclear Sciences (Seoul) (Wonjaryogwon. Yon gu Nonmun Chip) (South Korea)

J. Nucl. Sci. Technol. (Tokyo)
Journal of Nuclear Science and Technology (Tokyo) (Japan)

J. Nutr.
Journal of Nutrition, The (U.S.)

J. Obstet. Gynaecol. Brit. Commonwealth
Journal of Obstetrics and Gynaecology of The British Commonwealth (England)

J. Occup. Med.
Journal of Occupational Medicine (U.S.)

Johns Hopkins Med. J.
Johns Hopkins Medical Journal (U.S.)

J. Okla. State Med. Ass.
Journal of the Oklahoma State Medical Association, The (U.S.)

J. Opt. Soc. Amer.
Journal of the Optical Society of America (U.S.)

J. Oral Med.
Journal of Oral Medicine (U. S.)

J. Oral Surg.
Journal of Oral Surgery (U.S.)

J. Organometal. Chem. (Amsterdam)
Journal of Organometallic Chemistry (Amsterdam) (Netherlands)

J. Org. Chem.
Journal of Organic Chemistry, The (U.S.)

J. Parasitol.
Journal of Parasitology, The (U.S.)

J. Pathol.
Journal of Pathology (Formerly Journal of Pathology and Bacteriology, The) (Scotland)

J. Pediat.
Journal of Pediatrics, The (U.S.)

J. Pediat. Surg.
Journal of Pediatric Surgery (U.S.)

J. Petrol. Technol.
Journal of Petroleum Technology (U.S.)

J. Pharmacol. Exp. Ther.
Journal of Pharmacology and Experimental Therapeutics, The (U.S.)

J. Pharm. Pharmacol., Suppl.
Journal of Pharmacy and Pharmacology, Supplement (England)

J. Pharm. Sci.
Journal of Pharmaceutical Sciences (U.S.)

J. Photogr. Sci.
Journal of Photographic Science (England)

J. Phycol.
Journal of Phycology (U. S.)

J. Phys. (Paris)
Journal de Physique (Paris) (Formerly le Journal de Physique et le Radium) (France)

J. Phys. (Paris), Colloq.
Journal de Physique (Paris), Colloque (France)

J. Phys., A (London)
Journal of Physics, A (London). Proceedings of the Physical Society (General) (Supersedes in Part Proceedings of the Physical Society (London)) (England)

J. Phys., B (London)
Journal of Physics, B (London). Proceedings of the Physical Society (Atomic and Molecular Physics) (Supersedes in Part Proceedings of the Physical Society (London)) (England)

J. Phys., C (London)
Journal of Physics, C (London) Proceedings of the Physical Society (Solid State Physics) (Supersedes in Part of the Physical Society (London)) (England)

J. Phys., D (London)
Journal of Physics, D (London) (Supersedes British Journal of Applied Physics) (England)

J. Phys., E (London)
Journal of Physics, E (Supersedes Journal of Scientific Instruments) (England)

J. Phys. Chem.
Journal of Physical Chemistry, The (U.S.)

J. Phys. Chem. Solids
Journal of Physics and Chemistry of Solids (Formerly Physics and Chemistry of Solids, The) (England)

J. Physiol. (London)
Journal of Physiology, The (London) (England)

J. Physiol. (Paris), Suppl.
Journal de Physiologie (Paris), Supplement (France)

J. Phys. Soc. Jap.
Journal of the Physical Society of Japan (Japan)

XUM

J. Phys. Soc. Jap., Suppl.
Journal of the Physical Society of Japan, Supplement (Japan)

J. Plasma Phys.
Journal of Plasma Physics (England)

J. Polarogr. Soc.
Journal of The Polarographic Society (England)
Ceased Publication

J. Pollut. Contr.
Journal of Pollution Control (Japan)

J. Polym. Sci., Part A-1
Journal of Polymer Science, Part A-1 Polymer Chemistry (U.S.)

J. Polym. Sci., Part A-2
Journal of Polymer Science, Part A-2 Polymer Physics (U.S.)

J. Polym. Sci., Part B
Journal of Polymer Science. Part B Polymer Letters (U.S.)

J. Polym. Sci., Part C
Journal of Polymer Science. Part C Polymer Symposia (U.S.)

J. Power Div., Amer. Soc. Civil Eng.
Journal of the Power Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Prakt. Chem.
Journal fuer Prakitsche Chemie. (East Germany)

J. Prestressed Concrete Inst.
Journal of the Prestressed Concrete Institute (U.S.)

J. Proc. Roy. Soc. N. S. W.
Journal and Proceedings of the Royal Society of New South Wales (Australia)

J. Prosth. Dent.
Journal of Prosthetic Dentistry, The (U.S.)

J. Protozool.
Journal of Protozoology, The (U.S.)

J. Psychiat. Res.
Journal of Psychiatric Research (England)

J. Quant. Spectrosc. Radiative Transfer
Journal of Quantitative Spectroscopy and Radiative Transfer (England)

J. Radiat. Res.
Journal of Radiation Research (Japan)

J. Radioanal. Chem.
Journal of Radioanalytical Chemistry (Netherlands-Hungary)

J. Radiol., Electrol., Med. Nucl.
Journal de Radiologie, d'Electrologie, et de Medicine Nucleaire (France)

J. Radio Res. Lab., Tokyo
Journal of the Radio Research Laboratories, Tokyo (Japan)

J. Rech. Atmos.
Journal de Recherches Atmospheriques (France)

J. Reprod. Fert.
Journal of Reproduction and Fertility (England)

J. Res. Inst. Catal., Hokkaido Univ.
Journal of the Research Institute for Catalysis, Hokkaido University (Japan)

J. Res. Nat. Bur. Stand., A
Journal of Research of the National Bureau of Standards, A (U.S.)

J. Res. Nat. Bur. Stand., B
Journal of Research of the National Bureau of Standards, B (U.S.)

J. Roy. Astron. Soc. Can.
Journal of the Royal Astronomical Society of Canada (Canada)

J. Roy. Coll. Surg. Edinburgh
Journal of the Royal College of Surgeons of Edinburgh (Scotland)

J. Roy. Inst. Public Health
Journal of the Royal Institute of Public Health (England)

J. Roy. Microscop. Soc.
Journal of the Royal Microscopical Society (England)

J. Roy. Nav. Med. Serv. (London)
Journal of the Royal Naval Medical Service (London) (England)

J. Roy. Statist. Soc., Ser. C
Journal of the Royal Statistical Society, Series C. Applied Statistics (England)

J. S. Afr. Chem. Inst.
Journal of the South African Chemical Institute (South Africa)

J. Sanit. Eng. Div., Amer. Soc. Civil Eng.
Journal of the Sanitary Engineering Division, Proceedings of The American Society of Civil Engineers (U.S.)

J. S. Calif. State Dent. Ass.
Journal of the Southern California State Dental Association (U.S.)

J. Sci. Eng. Res., Indian Inst. Technol., Kharagpur
Journal of Science and Engineering Research, Indian Institute of Technology, Kharagpur (India)

J. Sci. Food Agr.
Journal of the Science of Food and Agriculture (England)

J. Sci. Hiroshima Univ. Ser. A-II
Journal of Science of the Hiroshima University. Series A-II (Japan)

J. Sci. Ind. Res.
Journal of Scientific and Industrial Research (India)

J. S. C. Med. Ass.
Journal of the South Carolina Medical Association (U. S.)

J. Sediment. Petrol.
Journal of Sedimentary Petrology (U.S.)

J. Sheffield Univ. Met. Soc.
Journal of the Sheffield University Metallurgical Society (England)

J. Soc. Cosmet. Chem.
Journal of the Society of Cosmetic Chemists (British Edition) (England)

J. Soil Mech. Found. Div., Amer. Soc. Civil Eng.
Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Soil Sci.
Journal of Soil Science, The (England)

J. Solid State Chem.
Journal of Solid State Chemistry (U. S.)

J. Sound Vib.
Journal of Sound and Vibration (England)

J. Spacecraft Rockets
Journal of Spacecraft and Rockets (U.S.)

J. Starch Technol. Res. Soc. Jap.
Journal of Starch Technology Research Society of Japan (Japan)

J. Statist. Phys.
Journal of Statistical Physics (U.S. - England)

J. Stored Prod. Res.
Journal of Stored Products Research (England)

J. Strain Anal.
Journal of Strain Analysis (England)

J. Struct. Div., Amer. Soc. Civil Eng.
Journal of the Structural Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Surg. Oncol.
Journal of Surgical Oncology (U. S.)

J. Surg. Res.
Journal of Surgical Research, The (U.S.)

J. Syst. Eng.
Journal of Systems Engineering (England)

J. Tenn. Acad. Sci.
Journal of the Tennessee Academy of Science (U.S.)

J. Tenn. Med. Ass.
Journal of the Tennessee Medical Association (U.S.)

J. Theor. Biol.
Journal of Theoretical Biology (England)

J. Tokyo Univ. Fish.
Journal of the Tokyo University of Fisheries (Japan)

J. Trauma
Journal of Trauma (U. S.)

J. Ultrastruct. Res.
Journal of Ultrastructure Research (U.S.)

Junkatsu
Junkatsu (Journal of the Japan Society of Lubrication Engineers) (Japan)

J. Urol.
Journal of Urology, The (U.S.)

J. Urol. Nephrol.
Journal d'Urologie et de Nephrologie (France)

J. Urol. Nephrol., Suppl.
Journal d'Urologie et de Nephrologie, Supplement (France)

J. Vac. Sci. Technol.
Journal of Vacuum Science and Technology, The (U.S.)

J. Virol.
Journal of Virology (U.S.)

J. Water Pollut. Contr. Fed.
Journal of the Water Pollution Control Federation (Formerly Sewage and Industrial Wastes) (U.S.)

J. Waterways Harbors Div., Amer. Soc. Civil Eng.
Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers (U.S.)

J. Wildlife Manage.
Journal of Wildlife Management (U.S.)

K

Kagaku (Tokyo)
Kagaku (Tokyo) (Science) (Japan)

Kagaku Gijutsucho Geppo
Kagaku Gijutsucho Geppo (Bulletin of the Science and Technology Agency) (Japan)

Kagaku Gijutsucho Shigen Chosa-kai Hokoku
Kagaku Gijutsucho Shigen Chosa-kai Hokoku (Japan)

Kagaku Keisatsu Kenkyusho Hokoku
Kagaku Keisatsu Kenkyusho Hokoku (Reports of the National Research Inst. of Police Science) (Japan)

Kagaku Kogaku
Kagaku Kogaku (Chemical Engineering) (Japan)

Kagaku Kogyo, Suppl.
Kagaku Kogyo, Supplement (Chemical Industry, Supplement) (Japan)

Kagaku To Seibutsu
Kagaku To Seibutsu (Chemistry and Biology) (Japan)

Kagoshima Daigaku Igaku Zasshi
Kagoshima Daigaku Igaku Zasshi (Medical Journal of Kagoshima University) (Japan)

Kaiun
Kaiun (Shipping) (Japan)

Kaku Igaku
Kaku Igaku (Nippon Kaku Igakkai Kikanshi) (Japanese Journal of Nuclear Medicine) (Japan)

Kakuriken Kenkyu Hokoku
Kakuriken Kenkyu Hokoku (Japan)

Kakuyugo Kenkyu
Kakuyugo Kenkyu (Nuclear Fusion Research Report) (Japan)

Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku
Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku (Bulletin of the Industrial Research Institute of Kanagawa Prefecture) (Japan)

Kanazawa Daigaku Kogakubu Kiyo
Kanazawa Daigaku Kogakubu Kiyo (Memoirs of the Faculty of Technology, Kanazawa University) (Japan)

Kanazawa Irigaku Sosho
Kanazawa Irigaku Sosho (Journal of Radiology and Physical Therapy, University of Kanazawa, The) (Japan)

Kardiologiya
Kardiologiya (U.S.S.R.)

Karyoku Hatsuden
Karyoku Hatsuden (The Thermal Power) (Japan)

Kawasaki Giho
Kawasaki Giho (Kawasaki Technical Review) (Japan)

Keikinzoku
Keikinzoku (Light Metals (Tokyo)) (Japan)

Keikinzoku Yosetsu
Keikinzoku Yosetsu (Japan Light Metal Welding) (Japan)

Keio Igaku
Keio Igaku (Journal of the Keio Medical Society) (Japan)

Kem. Kozlem.
Kemiai Kozlemenyek (Formerly Magyar Tudomanyos Akademia Kemiai Tudomanyos Osztalyanak Kozlemenyei) (Hungary)

Kem. Teollisuus
Kemian Teollisuus (Finland)
Supersedes Teknillisen Kemian Aikakauslehti

Kenchiku Kenkyusho Nenpo
Kenchiku Kenkyusho Nenpo (Japan)

Kensetsu Kinki
Kensetsu Kinki (Construction Machinery) (Japan)

Kensetsu No Kikaika
Kensetsu No Kikaika (Construction Mechanization) (Japan)

Keram. Z.
Keramische Zeitschrift (West Germany)

Kernenergie
Kernenergie (East Germany)

Kerntechnik
Kerntechnik. The Journal for Nuclear Engineers and Scientists (West Germany)

KFKI (Kozp. Fiz. Kut. Intez.) Kozlem.
KFKI (Kozponti Fizikai Kutato Intezet) Kozlemenyek (Hungary)

Kgl. Dan. Vidensk. Selsk., Mat.-Fys. Medd.
Kongelige Danske Videnskabernes Selskab, Det, Matematisk-Fysisk Meddelelser (Denmark)

Kgl. Vet.- Landbohoejsk., Arsskr.
Kongelige Veterinar - og Landbohoejskole, Arsskrift (Denmark)

Khidrol. Meteorol.
Khidrologiya i Meteorologiya (Bulgaria)

Khim.-Farm. Zh.
Khimiko-Farmatsevticheskii Zhurnal (U.S.S.R.)

Khim. Prom. (Moscow)
Khimicheskaya Promyshlennost (Moscow) (U.S.S.R.)

Khim. Prom. Ukr.
Khimicheskaya Promyshlennost Ukrainy (Ukrainian S.S.R.)

Khim. Tekhnol.
Khimicheskaya Tekhnologiya (Ukrainian S.S.R.)

Khim. Tekhnol. Topliv Masel
Khimiya i Tekhnologiya Topliv i Masel (U.S.S.R.)
Issued in English Translation as Chemistry and Technology of Fuels and Oils (USSR)

Khim. Volokna
Khimicheskie Volokna (U.S.S.R.)

Khim. Vys. Energ.
Khimiya Vysokikh Energiya (U.S.S.R.)
Issued in English Translation as High Energy Chemistry (USSR)

Khirurgiya (Moscow)
Khirurgiya (Moscow) (U.S.S.R.)

Khlopkovodstvo
Khlopkovodstvo (U.S.S.R.)

Kikai Shikenjo Shoho
Kikai Shikenjo Shoho (Journal of Mechanical Laboratory) (Japan)

Kinderaerztl. Prax.
Kinderaerztliche Praxis (East Germany)

Kinet. Katal.
Kinetika i Kataliz (U.S.S.R.)
Issued in English Translation as Kinetics and Catalysis (USSR)

Kinki Aruminyumu Hyomenshori Kenkykai Kaishi
Kinki Aruminyumu Hyomenshori Kenyukai Kaishi (Japan)

Kinki Daigaku Genshiryoku Kenkyusho Nenpo
Kinki Daigaku Genshiryoku Kenkyusho Nenpo (Annual Reports of Kinki University Atomic Energy Research Institute) (Japan)

Kinzoku
Kinzoku (Metals) (Japan)

Kinzoku Hyomen Gijutsu
Kinzoku Hyomen Gijutsu (The Journal of the Metal Finishing Society of Japan) (Japan)

Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku
Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku (Report of the National Research Institute for Metals) (Japan)

Kiseri. Orvostud.
Kiserletes Orvostudomany (Hungary)

Kitakanto Igaku
Kitakanto Igaku (Kitakanto Medical Journal) (Japan)

Kitasato Arch. Exp. Med.
Kitasato Archives of Experimental Medicine, The (Japan)

Kleintier-Prax.
Kleintier-Praxis (West Germany)

Klepzig Fachber.
Klepzig Fachberichte fuer die Fuehrungskraefte aus Maschinenbau und Huettenwesen (Formerly Klepzigs Anzeiger fuer die Berg-, Huetten-, Metall- und Maschinenindustrie) (West Germany)

Klin. Khir.
Klinicheskaya Khirurgiya (Ukrainian S.S.R.)

Klin. Med. (Moscow)
Klinicheskaya Meditsina (Moscow) (U.S.S.R.)

Klin. Med. (Vienna)
Klinische Medizin (Vienna) (Austria)

Klin. Monatsbl. Augenheilk.
Klinische Monatsblaetter fuer Augenheilkunde und fuer Augenaerztliche Fortbildung (West Germany)

Klin. Oczna
Klinika Oczna (Poland)

Klin. Wochensch.
Klinische Wochenschrift (West Germany)

Koatsuryoku
Koatsuryoku (High Pressure) (Japan)

Kobe Kogyo Giho
Kobe Kogyo Giho (Kobe Kogyo Technical Report) (Japan)

Kobe Seiko Giho
Kobe Seiko Giho (Kobe Steel Works Engineering Reports) (Japan)

Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen
Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen (Review of Kobe University of Mercantile Marine. Part II. Navigation, Marine Engineering, and Scientific Section) (Japan)

Kobunshi
Kobunshi (High Polymers, Japan) (Japan)

Kobunshi Kagaku
Kobunshi Kagaku (Chemistry of High Polymers) (Japan)

Kobunshi Kako
Kobunshi Kako (Polymer Application) (Japan)

Kobutsugaku Zasshi
Kobutsugaku Zasshi (Journal of the Mineralogical Society of Japan) (Japan)

Kodaikanal Observ. Bull., Ser. A
Kodaikanal Observatory Bulletin, Series A (India)

Kogaku To Gijutu
Kogaku To Gijutu (Engineering and Technology) (Japan)

Kogyo Kagaku Zasshi
Kogyo Kagaku Zasshi (Japan)

Kogyo Rea Metaru
Kogyo Rea Metaru (The Industrial Rare Metals) (Japan)

Kohaszat
Kohaszat (Formerly Kohaszati Lapok) (Hungary)

K'o Hsueh Chi Lu
K'o Hsueh Chi Lu (Science Record) (China)

Kokobyogakkai Zasshi
Kokobyogakkai Zasshi (The Journal of the Japan Stomatologica Society) (Japan)

Kolloid. Zh.
Kolloidnyi Zhurnal (Colloid Journal) (U.S.S.R.)

Kolloid-Z. Z. Polym.
Kolloid-Zeitschrift und Zeitschrift fuer Polymere, zur Zeit Vereinigt mit den Kolloid-Beiheften (Formerly Kolloid-Zeitschrift, -Zeitschrift fuer Polymere) (West Germany)

Konkurito Janaru
Konkurito Janaru (Concrete Journal) (Japan)

Kon. Ned. Akad. Wetensch., Proc., Ser. B
Koninklijke Nederlandse Akademie van Wetenschappen, Proceedings, Series B. (Netherlands)

Konserv. Ovoshchesush. Prom.
Konservnaya i Ovoshchesushil'naya Promyshlennost (U.S.S.R)

Konzerv- Paprikaipar
Konzerv- es Paprikaipar (Hungary)

Korrosion
Korrosion (West Germany)

Kosankinbyo Kenkyu Zasshi
Kosankinbyo Kenkyu Zasshi (Journal of Tuberculosis and Leprosy) (Japan)

Koshu Eisei
Koshu Eisei (The Journal of Public Health Practice) (Japan)

Koshu Eiseiin Kenkyu Hokoku
Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health) (Japan)

Kosm. Biol. Med.
Kosmicheskaya Biologiya i Meditsina (U.S.S.R.)
Issued in English Translation as Space Biology and Medicine (USSR)

Kosm. Issled.
Kosmicheskie Issledovaniya (U.S.S.R.)
Issued in English Translation as Cosmic Research (USSR)

Kosm. Luchi
Kosmicheskie Luchi (U.S.S.R.)

Kovove Mater.
Kovove Materialy (Czechoslovakia)

Kozan Chishitsu
Kozan Chishitsu (Mining Geology) (Japan)

Krebsarzt
Krebsarzt, Der (Austria)

Krebsforsch. Krebsbekaempf.
Krebsforschung und Krebsbekaempfung (West Germany)

Ktavim
Ktavim (Israel)

Kukuruza
Kukuruza (U.S.S.R.)

Kumamoto Igakkai Zasshi
Kumamoto Igakkai Zasshi (The Journal of the Kumamoto Medical Society) (Japan)

Kurashiki Chuo Byoin Nenpo
Kurashiki Chuo Byoin Nenpo (Jahresbericht des Kurashiki-Zentralhospitals) (Japan)

Kurume Med. J.
Kurume Medical Journal, The (Japan)

Kuznechno-Shtampovochnoe Proizvod.
Kuznechno-Shtampovochnoe Proizvodstvo (U.S.S.R.)

Kyosai Iho
Kyosai Iho (Medical Journal of Mutual Aid Association) (Japan)

Kyoto Furitsu Ika Daigaku Zasshi
Kyoto Furitsu Ika Daigaku Zasshi (Journal of Kyoto Prefectural Medical University) (Japan)

Ky. Sch. J.
Kentucky School Journal (U.S.)

Kyushu Shika Gakkai Zasshi
Kyushu Shika Gakkai Zasshi (The Journal of the Kyushu Dental Society) (Japan)

Kyushu Ketsueki Kenkyu Dokokaishi
Kyushu Ketsueki Kenkyu Dokokaishi (Journal of Kyushu Hematological Society) (Japan)

L

Lab. Anim.
Laboratory Animals (England)

Lab. Delo
Laboratornoe Delo (U.S.S.R.)

Labdev (Kanpur)
Labdev (Kanpur) (India)

Lab. Invest.
Laboratory Investigation. A Journal of Experimental Methods and Pathology (U.S.)

Lab. Pract.
Laboratory Practice (England)

Lahey Clin. Found. Bull.
Lahey Clinic Foundation Bulletin (Formerly Lahey Clinic Bulletin) (U.S.)

Lancet
Lancet, The (England)

Landarzt
Landarzt (West Germany)

Landbouwk. Tijdschr.
Landbouwkundig Tijdschrift (Netherlands)

Landwirt. Forsch.
Landwirtschaftliche Forschung (West Germany)

Langenbecks Arch. Chir.
Langenbecks Archiv fuer Chirurgie (Formerly Archiv fuer Klinische Chirurgie, Langenbecks) (West Germany)

Laryngoscope
Laryngoscope, The (U.S.)

Laser Rev.
Laser Review (England)

Lastechniek
Lastechniek (Netherlands)

Latv. PSR Zinat. Akad. Vestis
Latvijas PSR Zinatnu Akademijas Vestis (Latvian S.S.R.)

Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.
Latvijas PSR Zinatnu Akademijas Vestis, Fizikas un Tehnisko Zinatnu Serija (Latvian S.S.R.)

Lav. Umano
Lavoro Umano (Italy)

Lav. Umano, Suppl.
Lavoro Umano, Supplemento (Italy)

Leather Sci. (Madras, India)
Leather Science (Madras, India) (India)

Lect. Theor. Phys.
Lectures in Theoretical Physics (U. S.)

L E (Lebensm. Ernaehr.)
L und E (Lebensmittel und Ernaehrung) (Austria)

Leprosy Rev.
Leprosy Review (England)

Lesnictvi
Lesnictvi (Czechoslovakia)

Lett. Nuovo Cim.
Lettere al Nuovo Cimento (Italy)

Liet. Fiz. Rinkinys, Liet. TSR Mokslu Akad., Liet. TSR Aukst. Mokyklos
Lietuvos Fizikos Rinkinys, Lietuvos TSR Mokslu Akademija, Lietuvos TSR Aukstosios Mokyklos (Lithuanian S.S.R.)

Liet. TSR Mokslu Akad. Darbai, Ser. B
Lietuvos TSR Mokslu Akademija Darbai, Serija B (Lithuanian S.S.R.)

Life Sci.
Life Sciences. (U.S.)

Life Sci., Part II
Life Sciences, Part II. Biochemistry, General and Molecular Biology (U. S. - England)

Light Metal Age
Light Metal Age (U.S.)

Limnol. Oceanogr.
Limnology and Oceanography (U.S.)

Lipids
Lipids (U.S.)

Liteinoe Proizvod.
Liteinoe Proizvodstvo (U.S.S.R.)

Lithos
Lithos (Norway)

Litol. Polez. Iskop.
Litologiya i Poleznye Iskopaemye (U.S.S.R.)

Lockheed Ga. Quart.
Lockheed Georgia Quarterly (U.S.)

Lucr. Stiint., Inst. Agron. Cluj, Ser. Med. Vet. Zooteh.
Lucrari Stiintifice, Institutul Agronomic Dr. Petru Groza Cluj, Seria Medicina Veterinara si Zootehnie (Romania)

Lucr. Stiint. Inst. Agron. N. Balcescu, Bucuresti, Ser. C
Lucrari Stiintifice ale Institutului Agronomic N. Balcescu, Bucuresti, Seria C (Romania)

Luftfahrttech.-Raumfahrttech.
Luftfahrttechnik-Raumfahrttechnik (West Germany)

Luz Fuerza
Luz y Fuerza (Spain)

Lymphology (Stuttgart)
Lymphology (Stuttgart) (West Germany)

Lyon Med.
Lyon Medical (France)

M

Mach. Design
Machine Design (U.S.)

Machinery (Engl.)
Machinery (England)

Mach. Mod.
Machine Moderne (France)

Macromolecules
Macromolecules (U.S.)

Magn. Gidrodin., Akad. Nauk Lat. SSR
Magnitnaya Gidrodinamika, Akademiya Nauk Latviiskoi SSR (Latvian S.S.R.)

Magy. Fiz. Foly.
Magyar Fizikai Folyoirat (Hungary)

Magy. Geofiz.
Magyar Geofizika (Hungary)

Magy. Kem. Foly.
Magyar Kemiai Folyoirat (Hungary)

Magy. Kem. Lapja
Magyar Kemikusok Lapja (Hungary)

Magy. Radiol.
Magyar Radiologia (Hungary)

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Maize Genet. Coop. News Lett.
Maize Genetics Cooperation News Letter (U.S.)

Makromol. Chem.
Makromolekueare Chemie, Die (Switzerland)

Malacologia
Malacologia (U.S.)

Manchester Med. Gaz.
Manchester Medical Gazette (England)

Manutention-Stockage
Manutention-Stockage (France)

Mar. Biol.
Marine Biology (Constitutes Proceedings of the International Interdisciplinary Conference on Marine Biology) (U.S.)

Mar. Eng. Nav. Architect
Marine Engineering and Naval Architect (England)

Mar. Technol. Soc. J.
Marine Technology Society Journal (U. S.)

Maschinenbautechnik
Maschinenbautechnik (East Germany)

Mashinostroitel
Mashinostroitel (U.S.S.R.)

Maskin Tidsskr. Maskin Verkstedtek.
Maskin Tidsskrift for Maskin og Verkstedteknikk (Norway)

Masui
Masui (The Japanese Journal of Anesthesiology) (Japan)

Mater. Eng.
Materials Engineering (Formerly Materials in Design Engineering) (U.S.)

Mater. Eval.
Materials Evaluation (Formerly Nondestructive Testing) (U.S.)

Mater. Protect.
Materials Protection (U.S.)

Mater. Res. Bull.
Materials Research Bulletin (U.S.)

Mater. Sci. Eng.
Materials Science and Engineering (Netherlands)

Math. Biosci.
Mathematical Biosciences (U.S.)

Mathematica
Mathematica (Romania)

Mathematika
Mathematika. A Journal of Pure and Applied Mathematics (England)

Mayo Clin., Proc.
Mayo Clinic, Proceedings (U.S.)

Md. State Med. J.
Maryland State Medical Journal (U.S.)

Meas. Contr.
Measurement and Control (Supersedes Transaction of the Society of Instrument Technology) (England)

Meas. Instrum. Rev.

Measurement and Instrument Review (Formerly Instrument Review) (England)

Meccanica
Meccanica (Italy)

Mec. Elec.
Mecanique Electricite (France)

Mech. Chem. Eng. Trans.
Mechanical and Chemical Engineering Transactions (Australia)

Mech. Eng.
Mechanical Engineering (U.S.)

Med. Ann. D. C.
Medical Annals of the District of Columbia (U.S.)

Med. Arh.
Medicinski Arhiv (Yugoslavia)

Med. Biol. Eng.
Medical and Biological Engineering (U.S.)

Med. Clin. N. Amer.
Medical Clinics of North America, The (U.S.)

Medd. Norsk Farm. Selsk.
Meddelelser fra Norsk Farmaceutisk Selskap (Norway)

Med. Dosw. Mikrobiol.
Medycyna Doswiadczalna i Mikrobiologia (Poland)

Meded. Kon. Vlaam. Acad. Wetensch. Belg., Kl. Wetensch.
Mededelingen van de Koninklijke Vlaamse Academie voor Wetenschappen, Letteren on Schone Kunsten van Belgie, Klasse der Wetenschappen (Belgium)

Meded. Vlaam. Chem. Ver.
Mededelingen van de Vlaamse Chemische Vereniging (Belgium)

Med. Exp.
Medicina Experimentalis (Switzerland)
Superseded by Medicina et Pharmacologia Experimentalis, later reverted to original name

Med. Gynaecol. Sociol.
Medical Gynaecology and Sociology (England)

Med. Hyg.
Medecine et Hygiene (Switzerland)

Medicamundi
Medicamundi (Netherlands)

Medicina (Buenos Aires)
Medicina (Buenos Aires) (Argentina)

Medicina (Mex.)
Medicina (Mexico)

Medico (Oporto)
Medico (Oporto) (Portugal)

Med. Interna
Medicina Interna (Romania)

Med. J. Aust.
Medical Journal of Australia, The (Australia)

Med. J. Hiroshima Univ.
Medical Journal of Hiroshima University (Hiroshima Daigaku Igaku Zasshi) (Japan)

Med. J. Malaya
Medical Journal of Malaya, The (Malaya)

Med. J. Osaka Univ. (Engl. Ed.)
Medical Journal of Osaka University (English Edition) (Japan)

Med. Klin. (Munich)
Medizinische Klinik (Munich) (West Germany)

Med. Lab.
Medizinische Laboratorium, Das (West Germany)

Med. Lavoro
Medicina del Lavoro, La (Italy)

Med. Leg. Domm. Corpor.
Medecine Legale et Dommage Corporel (France)

Med. Monatsschr.
Medizinische Monatsschrift (West Germany)

Med. Nucl.-Radiobiol. Lat.
Medicina Nucleare-Radiobiologica Latina (Formerly Radiobiologica Latina) (Italy)

Med. Pharmacol. Exp.
Medicina et Pharmacologia Experimentalis (Formerly Medicina Experimentalis) (Switzerland)

Med. Pracy
Medycyna Pracy (Poland)

Med. Pregl. (Novi Sad)
Medicinski Pregled (Novi Sad) (Yugoslavia)

Med. Radiogr. Photogr.
Medical Radiography and Photography (U.S.)

Med. Radiol.
Meditsinskaya Radiologiya (U.S.S.R.)

Med. Res. Eng.
Medical Research Engineering (Formerly American Journal of Medical Electronics) (U.S.)

Med. Welt
Medizinische Welt, Die (West Germany)

Med. Wet. (Poland)
Medycyna Weterynaryjna (Poland)

Med. World News
Medical World News (U.S.)

Med. Zh. Uzb.
Meditsinskii Zhurnal Uzbekistana (Uzbek S.S.R.)

Melliand Textilber.
Melliand Textilberichte (West Germany)

Mem. Acad. Chir.
Memoires de l'Academie de Chirurgie (France)

Mem. Acad. Cienc. Lisboa, Cl. Cienc.
Memoiras da Academia das Ciencias de Lisboa, Classe de Ciencias (Portugal)

Mem., Ass. Int. Hydrogeol., Reunion Istanbul
Memoires, Association Internationale des Hydrogeologues, Reunion d'Istanbul (Turkey)

Mem. Chubu Inst. Technol.
Memoirs of Chubu Institute of Technology (Chubu Koygo Daigaku Kyo) (Japan)

Mem. Coll. Agr., Kyoto Univ.
Memoirs of the College of Agriculture, Kyoto University (Japan)

Mem. Fac. Eng., Hiroshima Univ.
Memoirs of the Faculty of Engineering, Hiroshima University (Japan)

Mem. Fac. Eng., Hokkaido Univ.
Memoirs of the Faculty of Engineering, Hokkaido University (Japan)

Mem. Fac. Eng., Kobe Univ.
Memoirs of the Faculty of Engineering, Kobe University (Japan)

Mem. Fac. Eng., Kyoto Univ.
Memoirs of the Faculty of Engineering, Kyoto University (Japan)

Mem. Fac. Eng., Nagoya Univ.
Memoirs of the Faculty of Engineering, Nagoya University (Japan)

Mem. Fac. Eng., Osaka City Univ.
Memoirs of the Faculty of Engineering, Osaka City University (Japan)

Mem. Fac. Eng., Tamagawa Univ.
Memoirs of the Faculty of Engineering, Tamagawa University (Japan)

Mem. Fac. Sci., Kyoto Univ., Ser. Geol. Mineral.
Memoirs of the Faculty of Science, Kyoto University, Series of Geology and Mineralogy (formerly Memoirs of the College of Science, University of Kyoto, Series B) (Japan)

Mem. Fac. Sci., Kyoto Univ., Ser. Phys., Astrophys., Geophys., Chem.
Memoirs of the Faculty of Science, Kyoto University, Series of Physics, Astrophysics, Geophysics, and Chemistry (Formerly Memoirs of the College of Science, University of Kyoto. Series A) (Japan)

Mem. Fac. Sci., Kyushu Univ., Ser. B
Memoirs of the Faculty of Science, Kyushu University, Series B. Physics (Japan)

Mem. Inst. Sci. Ind. Res. Osaka Univ.
Memoirs of the Institute of Scientific and Industrial Research, Osaka University (Japan)

Mem. Osaka Kyoiku Univ.
Memoirs of Osaka Kyoiku University (Japan)

Mem. Roy. Astron. Soc.
Memoirs of the Royal Astronomical Society (England)

Mem. Sci. Rev. Met.
Memoires Scientifiques de la Revue de Metallurgie, Les (Formerly a Part of Revue de Metallurgie) (France)

Mem. Soc. Roy. Sci. Liege
Memoires de la Societe Royale des Sciences de Liege (Belgium)

Mem. Tokyo Univ. Agr.
Memoirs of the Tokyo University of Agriculture (Japan)

Mendeleev Chem. J. (Engl. Transl.)
Mendeleev Chemistry Journal (English Translation of Zhurnal Vsesoyuznogo Khimicheskogo Obshchestva imeni D. I. Mendeleeva) (U. S.)

Meres Automat.
Meres es Automatika (Hungary)

Mes., Regul., Automat.
Mesures, Regulation, Automatisme (France)

Messtechnik
Messtechnik. Zeitschrift fuer Instrumentenkunde (Supersedes Zeitschrift fuer Instrumentenkunde) (West Germany)

Mes.-Steuern-Regeln
Messen-Steuern-Regeln (East Germany)

Metab., Clin. Exp.
Metabolism, Clinical and Experimental (U.S.)

Metal Constr. Brit. Weld. J.
Metal Construction and British Welding Journal (England)
Supersedes British Welding Journal

Metal Finish. J. (London)
Metal Finishing Journal (London) (England)

Metal Form. Drop Forger
Metal Forming Incorporating the Drop Forger (Formerly Metal Treatment Incorporating the Drop Forger) (England)

Metall
Metall. Internazionale Zeitschrift fuer Technik und Wirtschaft (West Germany)

Metalloberflaeche
Metalloberflaeche (West Germany)

Metallography
Metallography. An International Journal (U.S.)

Metalloved. Term. Obrab. Metal.
Metallovedenie i Termicheskaya Obrabotka Metallov (Forserly Metallovedenie i Obrabotka Metallov) (U.S.S.R.)
For English Translation see Metal Science and Heat Treatment (USSR)

Metallurgia
Metallurgia (England)

Metal Progr.
Metal Progress (U.S.)

Metals Abstr.
Metals Abstracts (Successor to Review of Metal Literature and Metallurgical Abstracts) (U.S. - England)

Metal Sci. J.
Metal Science Journal (England)

Metals Eng. Quart.
Metals Engineering Quarterly (U.S.)

Metalurgia (Bucharest)
Metalurgia (Bucharest) (Romania)

Metalurgia (Sao Paulo)
Metalurgia (Sao Paulo) (Brazil)

Metalworking
Metalworking (U.S.)

Metaux (Corros.-Ind.)
Metaux (Corrosion-Industrie) (France)

Met. Constr. Mec.
Metallurgie et la Construction Mecanique (France)

Meteoritics
Meteoritics (U. S.)

Meteoritika
Meteoritika (U.S.S.R.)

Meteorol. Abh., Inst. Meteorol. Geophys., Freie Univ. Berlin
Meteorologische Abhandlungen, Institut fuer Meteorologie und Geophysik, Freie Universitaet Berlin (West Germany)

Meteorol. Mag.
Meteorological Magazine (England)

Meteorol. Monogr.
Meteorological Monographs (U.S.)

Meteorol. Rundsch.
Meteorologische Rundschau (West Germany)

XUM

Meteorol. Zpr.
Meteorologicke Zpravy (Czechoslovakia)

Method. Phys. Anal.
Methodes Physiques d'Analyse (France)

Methods Inform. Med.
Methods of Information in Medicine
(Supersedes Medical Documentation) (West Germany)

Met. Ital.
Metallurgia Italiana (Includes the Section Atti Notizie, Associazione Italiana de Metallurgia) (Italy)

Met. Metalloved. Chist. Metal., Sb. Nauch. Rabot
Metallurgiya i Metallovedenie Chistykh Metallov, Moskovskii Inzhenerno-Fizicheskii Institut, Sbornik Nauchnykh Rabot (U.S.S.R.)

Met. Rev. (Publ. in Metals Mater.)
Metallurgical Reviews (Published in Metals and Materials) (England)

Metrol. Insp.
Metrology and Inspection (England)

Met. Soc. Conf.
Metallurgical Society Conferences (U.S.)

Met. Trans.
Metallurgical Transactions (formerly Transactions of the Metallurgical Society of AIME and Transactions Quarterly of American Society for Metals) (U. S.)

Microbiology (USSR) (Engl. Transl.)
Microbiology (USSR) (English Translation of Mikrobiologiya) (U.S.)

Microchem. J.
Microchemical Journal (U.S.)

Micron
Micron (England)

Micronesica
Micronesica (Guam)

Microscope (Brighton)
Microscope (Brighton) (Merged with Crystal Front to form Microscope and Crystal Front, Reverted to Microscope with vol. 15, third quarter, 1967) (England)

Microstructures
Microstructures (U. S.)

Microtecnic (Lausanne)
Microtecnic (Lausanne) (Switzerland)

Mie Daigaku Nogakubu Gakujutsu Hokoku
Mie Daigaku Nogakubu Gakujutsu Hokoku (The Bulletin of the Faculty of Agriculture, Mie University) (Japan)

Mie Med. J.
Mie Medical Journal (Japan)

Mikol. Fitopatol.
Mikologiya i Fitopatologiya (U.S.S.R.)

Mikrobiologiya
Mikrobiologiya (U.S.S.R.)
For English Translation see Microbiology (USSR)

Mikrobiol. Zh.
Mikrobiologichenyi Zhurnal (Ukrainian S.S.R.)

Mikrochim. Acta
Mikrochimica Acta (Formerly Mikrochimica et Ichoanalytica Acta) (Austria)

Mikrochim. Acta, Suppl.
Mikrochimica Acta, Supplement (Austria)

Milchwissenschaft
Milchwissenschaft (West Germany)

Mil. Med.
Military Medicine (U.S.)

Miner. Deposita
Mineralium Deposita (West Germany)

Minerva Chir.
Minerva Chirgica (Italy)

Minerva Dermatol.
Minerva Dermatologica (Italy)

Minerva Fisiconucl.
Minerva Fisiconucleare. Giornale di Fisica Sanitaria e Protezione Contro le Radiazioni (Italy)

Minerva Ginecol.
Minerva Ginecologica (Italy)

Minerva Med.
Minerva Medica (Italy)

Minerva Med. Giuliana
Minerva Medica Giuliana. Supplemento a Minerva Medica (Italy)

Minerva Med. Sicil.
Minerva Medica Siciliana (Continuation of Gazzetta Medica Siciliana) Supplemento a Minerva Medica (Italy)

Minerva Neurochir.
Minerva Neurochirurgica (Italy)

Minerva Pediat.
Minerva Pediatrica (Italy)

Minerva Radiol.
Minerva Radiologica (Formerly Minerva Radiologica, Fisioterapica e Radiobiologica) (Italy)

Mines Mag.
Mines Magazine (U. S.)

Mines Met.
Mines et Metallurgie (France)

Mining Congr. J.
Mining Congress Journal (U.S.)

Mining Eng.
Mining Engineer, The, Incorporating the Transactions of the Institution of Mining Engineers (England)

Mining J. (London)
Mining Journal (London) (England)

Minn. Med.
Minnesota Medicine (U.S.)

Missouri Med.
Missouri Medicine (U.S.)

Mitsubishi Denki Giho
Mitsubishi Denki Giho (Mitsubishi Denki Technical Review) (Japan)

Mitsubishi Denki Lab. Rep.
Mitsubishi Denki Laboratory Reports (Japan)

Mitsubishi Juko Giho
Mitsubishi Juko Giho (Mitsubishi Heavy Industries Technical Review) (Japan)

Mitt. Ver. Grosskesselbesitzer
Mitteilungen der Vereinigung der Grosskesselbesitzer (West Germany)

Mitt. Ver. Grosskesselbetr.
Mitteilungen der Vereinigung der Grosskesselbetreiber (Formerly Mitteilungen der Vereinigung der Grosskesselbesitzer) (West Germany)

Miyazaki Daigaku Nogakubu Kenkyu Jiho
Miyazaki Daigaku Nogakubu Kenkyu Jiho (Bulletin of the Faculty of Agriculture, University of Miyazaki) (Japan)

Mod. Cast.
Modern Castings (Includes New Technology Section) (U.S.)

Mod. Kemi
Modern Kemi (Sweden)

Mod. Mach. Shop
Modern Machine Shop (U.S.)

Mod. Mater., Advan. Develop. Appl.
Modern Materials, Advances in Development and Applications (U.S.)

Mod. Packag.
Modern Packaging (U.S.)

Mol. Biol. (USSR) (Engl. Transl.)
Molecular Biology (USSR) (English Translation of Molekulyarnaya Biologiya) (U.S.)

Mol. Cryst.
Molecular Crystals (England)
Superseded by Molecular Crystals and Liquid Crystals

Mol. Cryst. Liquid Cryst.
Molecular Crystals and Liquid Crystals (formerly Molecular Crystals) (England)

Mol. Gen. Genet.
Molecular and General Genetics (MGG) (Continuation of Zeitschrift fuer Vererbungslehre) (West Germany)

Mol. Phys.
Molecular Physics (England)

Moly Pays Off
Moly Pays Off (U.S.)

Monatsber. Deut. Akad. Wiss. Berlin
Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin (East Germany)

Monatsh. Chem.
Monatshefte fuer Chemie (Austria)

Monatsschr. Kinderheilk.
Monatsschrift fuer Kinderheilkunde (West Germany)

Monatsschr. Unfallheilk.
Monatsschrift fuer Unfallheilkunde und Versicherungs-Medizin (West Germany)

Mon. Notic. Roy. Astron. Soc.
Monthly Notices of the Royal Astronomical Society (England)

Monogr. Nucl. Med. Biol.
Monographs on Nuclear Medicine and Biology (Netherlands)

Mon. Weather Rev.
Monthly Weather Review (U.S.)

Moon
Moon, The. An International Journal of Lunar Studies (Netherlands)

Morsk. Sb.
Morskoi Sbornik (U.S.S.R.)

Mosquito News
Mosquito News (U.S.)

Motor Ship
Motor Ship (England)

Mt. Geol.
Mountain Geologist (U.S.)

Muenchen. Med. Wochenschr.
Muenchener Medizinische Wochenschrift (West Germany)

Mukogawa Joshi Daigaku Kiyo, Shizenkagakuhen
Mukogawa Joshi Daigaku Kiyo, Shizenkagakuhen (Bulletin of Mukogawa Womens University, Natural Science) (Japan)

Mutat. Res.
Mutation Research (Netherlands)

Mycologia
Mycologia (U.S.)

Mycopathol. Mycol. Appl.
Mycopathologia et Mycologia Applicata (Netherlands)

N

Nagasaki Daigaku Suisangakubu Kenkyu Hokoku
Nagasaki Daigaku Suisangakubu Kenkyu Hokoku (Bulletin of the Faculty of Fisheries, Nagasaki University) (Japan)

Nagoya J. Med. Sci.
Nagoya Journal of Medical Science, The (Japan)

Nagoya Kogyo Gijutsu Shikensho Hokoku
Nagoya Kogyo Gijutsu Shikensho Hokoku (Reports of the Government Industrial Research Institute, Nagoya) (Japan)

Nahrung
Nahrung, Die (East Germany)

Naika
Naika (Internal Medicine) (Japan)

Naika Hokan
Naika Hokan (Japanese Archives of Internal Medicine) (Japan)

Naikai-ku Suisan Kenkyusho Kenkyu Hokoku
Naikai-ku Suisan Kenkyusho Kenkyu Hokoku (Bulletin of Naikai Regional Fisheries Research Lab.) (Japan)

Nankyoku Shiryo
Nankyoku Shiryo (Antarctic Record) (Japan)

Nara Igaku Zasshi
Nara Igaku Zasshi (Journal of the Nara Medical Association) (Japan)

Nara Kogyo Koto Senmon Gakko Kenkyu Kiyo
Nara Kogyo Koto Senmon Gakko Kenkyu Kiyo (Research Reports of Nara Technical College) (Japan)

Nat. Tech. Rep. (Matsushita Elec. Ind. Co., Osaka)
National Technical Report (Matsushita Electric Industrial Co., Osaka) (Japan)

Natur. Appl. Sci. Bull.
Natural and Applied Science Bulletin (Philippines)

Natur. Can.
Naturaliste Canadien (Canada)

Nature (London)
Nature (London) (England)

Naturwissenschaften
Naturwissenschaften, Die (West Germany)

Naturwiss. Rundsch.
Naturwissenschaftliche Rundschau (West Germany)

Nauch. Tr., Leningrad. Lesotekh. Akad.
Nauchnye Trudy, Leningradskaya Lesotekhnicheskaya Akademiya (U.S.S.R.)

Nauch. Tr., Tashkent. Gos. Univ.
Nauchnye Trudy, Tashkentskii Gosudarstvennyi Universitet imeni V. I. Lenina (U.S.S.R.)

Nav. Eng. J.
Naval Engineers Journal (U.S.)

NCAR (Nat. Cent. Atmos. Res.) Quart.
NCAR (National Center for Atmospheric Research) Quarterly (U.S.)

N. C. Med. J.
North Carolina Medical Journal, The (U. S.)

Nebr. State Med. J.
Nebraska State Medical Journal, The (U.S.)

NEC (Nippon Elec. Co.) Res. Develop.
NEC (Nippon Electric Company), Research and Development (Japan)

Ned. Tijdschr. Geneesk.
Nederlands Tijdschrift voor Geneeskunde (Netherlands)

Ned. Tijdschr. Natuurk.
Nederlands Tijdschrift voor Natuurkunde (Netherlands)

Neftegazov. Geol. Geofiz.
Neftegazovaya Geologiya i Geofizika (U.S.S.R.)

Nenryo Kyokai-shi
Nenryo Kyokai-shi (Journal of the Fuel Society of Japan) (Japan)

Neoplasma
Neoplasma (Czechoslovakia)

Nepegeszsegugy
Nepegeszsegugy (Hungary)

Nerv. Sist., Leningrad. Gos. Univ., Fiziol. Inst.
Nervnaya Sistema, Leningradskii Gosudarstvennyi Universitet imeni A. A. Zhdanova, Fiziologicheskii Institut (U.S.S.R.)

Neth. J. Agr. Sci.
Netherlands Journal of Agricultural Science (Netherlands)

Neth. J. Zool.
Netherlands Journal of Zoology (Netherlands)

Neth. Milk Dairy J.
Netherlands Milk and Dairy Journal, The (Netherlands)

Neue Huette
Neue Huette (East Germany)

Neues Jahrb. Mineral., Abh.
Neues Jahrbuch fuer Mineralogie, Abhandlungen (West Germany)

Neues Jahrb. Mineral., Monatsh.
Neues Jahrbuch fuer Mineralogie, Monatshefte (West Germany)

XUM

Neue Phys.
Neue Physik (Austria)

Neue Tech.
Neue Technik (Switzerland)

Neue Tech., B
Neue Technik, B. Zeitschrift fuer Kerntechnik (Switzerland)

Neuro-Chir.
Neuro-Chirurgie. (France)

Neurol. India
Neurology India (India)

Neurol., Neurochir. Psychiat. Pol.
Neurologia, Neurochirurgia i Psychiatria Polska (Poland)

Neurology
Neurology (U.S.)

Neuropatol. Pol.
Neuropatologia Polska (Poland)

New Engl. J. Med.
New England Journal of Medicine, The (U.S.)

New Phys. (S. Korea)
New Physics (South Korea)

New Phys., (S. Korea) Suppl.
New Physics, Supplement (South Korea)

New Phytol.
New Phytologist, The (England)

New Sci.
New Scientist, The (England)

Newslett. ENEA Comput. Programme Libr.
Newsletter of the ENEA Computer Programme Library (Italy)

Newslett. Isotop. Generator Inform. Centre
Newsletter of the Isotopic Generator Information Centre (France)
Changed to Information Bulletin on Isotopic Generators

Nichidai Igaku Zasshi
Nichidai Igaku Zasshi (Nihon University Medical Journal) (Japan)

Nihon Univ. J. Med.
Nihon University Journal of Medicine, The (Japan)

Niigata Daigaku Kogakubu Kenkyu Hokoku
Niigata Daigaku Kogakubu Kenkyu Hokoku (Research Reports of the Faculty of Engineering, Niigata University) (Japan)

Niigata Igakkai Zasshi
Niigata Igakkai Zasshi (Niigata Medical Journal) (Japan)

Niihama Kogyo Koto Senmon Gakko Kiyo
Niihama Kogyo Koto Senmon Gakko Kiyo (Memoirs of the Niihama Technical College) (Japan)

Nippon Butsuri Gakkaishi
Nippon Butsuri Gakkaishi (Proceedings of the Physical Society of Japan) (Japan)

Nippon Byori Gakkai Kaishi
Nippon Byori Gakkai Kaishi (Transactiones Societatis Pathologicae Japonicae) (Japan)

Nippon Daicho Komonbyo Gakkai Zasshi
Nippon Daicho Komonbyo Gakkai Zasshi (Journal of the Japan Society of Colo-Proctology) (Japan)

Nippon Dent. Coll. Annu. Publ.
Nippon Dental College Annual Publications (Japan)

Nippon Dojo Hiryogaku Zasshi
Nippon Dojo Hiryogaku Zasshi (Journal of the Science of Soil and Manure) (Japan)

Nippon Eiseigaku Zasshi
Nippon Eiseigaku Zasshi (Japanese Journal of Hygiene) (Japan)

Nippon Ganka Gakkai Zasshi
Nippon Ganka Gakkai Zasshi (Acta Societatis Ophthalmologicae Japonicae) (Japan)

Nippon Ganka Kiyo
Nippon Ganka Kiyo (Folia Ophthalmologica Japonica) (Japan)

Nippon Gasu Kyokaishi
Nippon Gasu Kyokaishi (Journal of the Japan Gas Association) (Japan)

Nippon Geka Hokan
Nippon Geka Hokan (Archiv fuer Japanische Chirurgie) (Japan)

Nippon Genshiryoku Gakkaishi
Nippon Genshiryoku Gakkaishi (Journal of the Atomic Energy Society of Japan) (Japan)

Nippon Hinyokika Gakkai Zasshi
Nippon Hinyokika Gakkai Zasshi (The Japanese Journal of Urology) (Japan)

Nippon Igaku Hoshasen Gakkai Zasshi
Nippon Igaku Hoshasen Gakkai Zasshi (Nippon Acta Radiologica (Japan)

Nippon Ishikai Zasshi
Nippon Ishikai Zasshi (The Journal of the Japan Medical Association) (Japan)

Nippon Juigaku Zasshi
Nippon Juigaku Zasshi (Japanese Journal of Veterinary Science) (Japan)

Nippon Kagaku Seni Kenkyusho Koenshu
Nippon Kagaku Seni Kenkyusho Koenshu (Japan)

Nippon Kagaku Zasshi
Nippon Kagaku Zasshi (Journal of the Chemistry Society of Japan, Pure Chemistry Section) (Japan)

Nippon Kaisui Gakkaishi
Nippon Kaisui Gakkaishi (Bulletin of the Society of Sea Water Science, Japan) (Japan)

Nippon Kaiyo Gakkaishi
Nippon Kaiyo Gakkaishi (Journal of the Oceanographical Society of Japan) (Japan)

Nippon Ketsueki Gakkai Zasshi
Nippon Ketsueki Gakkai Zasshi (Acta Haematologica Japonica) (Japan)

Nippon Kikai Gakkai Rombunshu
Nippon Kikai Gakkai Rombunshu (Transactions of the Japanese Society of Mechanical Engineers) (Japan)

Nippon Kikai Gakkaishi
Nippon Kikai Gakkaishi (Journal of the Japan Society of Mechanical Engineers) (Japan)

Nippon Kinzoku Gakkai Kaiho
Nippon Kinzoku Gakkai Kaiho (Bulletin of the Japan Institute of Metals) (Japan)

Nippon Kogyo Kaishi
Nippon Kogyo Kaishi (Journal of the Mining and Metallurgical Institute of Japan) (Japan)

Nippon Kokan Giho
Nippon Kokan Giho (Japan Steel and Tube Technical Review) (Japan)

Nippon Koku Gakkaishi
Nippon Koku Gakkaishi (Journal of Japanese Society for Aeronautical and Space Science) (Japan)

Nippon Koshu Eisei Zasshi
Nippon Koshu Eisei Zasshi (Japanese Journal of Public Health) (Japan)

Nippon Kyobu Geka Gakkai Zasshi
Nippon Kyobu Geka Gakkai Zasshi (Journal of the Japanese Association for Thoracic Surgery) (Japan)

Nippon Naibumpi Gakkai Zasshi
Nippon Naibumpi Gakkai Zasshi (Folia Endocrinologica Japonica) (Japan)

Nippon Nogeikagaku Kaishi
Nippon Nogeikagaku Kaishi (Journal of the Agricultural Chemical Society of Japan) (Japan)

Nippon No Kagaku To Gijutsu
Nippon No Kagaku To Gijutsu (Science and Technology of Japan) (Japan)

Nippon Oyo Dobutsu Konchugaku Zasshi
Nippon Oyo Dobutsu Konchugaku Zasshi (Japanese Journal of Applied Entomology and Zoology) (Japan)

Nippon Ringaku Kaishi
Nippon Ringaku Kaishi (Journal of the Japanese Forestry Society) (Japan)

Nippon Sanka Fujinka Gakkai Zasshi
Nippon Sanka Fujinka Gakkai Zasshi (Journal of Japanese Obstetrics and Gynecological Society) (Japan)

Nippon Sanshigaku Zasshi
Nippon Sanshigaku Zasshi (The Journal of Sericultural Science of Japan) (Japan)

Nippon Seiko Giho
Nippon Seiko Giho (Japan Steel Works Technical Review) (Japan)

Nippon Shokakibyo Gakkai Zasshi
Nippon Shokakibyo Gakkai Zasshi (The Japanese Journal of Gastroenterology) (Japan)

Nippon Shokuhin Kogyo Gakkaishi
Nippon Shokuhin Kogyo Gakkaishi (Journal of Food Science and Technology) (Japan)

Nippon Shonika Gakkai Zasshi
Nippon Shonika Gakkai Zasshi (Acta Paediatrica Japonica) (Japan)

Nippon Suisan Gakkaishi
Nippon Suisan Gakkaishi (Bulletin of the Japanese Society of Scientific Fisheries) (Japan)

Nippon Taishitsugaku Zasshi
Nippon Taishitsugaku Zasshi (The Japanese Journal of Constitutional Medicine) (Japan)

Nishinihon J. Urol.
Nishinihon Journal of Urology (Japan)

Nogyo Gijutsu Kenkyusho Hokoku, D
Nogyo Gijutsu Kenkyusho Hokoku, D, Seiri, Iden, Sakumotsu Ippan (Bulletin of the National Institute of Agricultural Sciences, Series D) (Japan)

Non-ioniz. Radiat.
Non-ionizing Radiation (England)

Nord. Hyg. Tidskr.
Nordisk Hygienisk Tidskrift (Sweden)

Nord. Med.
Nordisk Medicin (Sweden)

Nord. Veterinarmed.
Nordisk Veterinarmedicin (Denmark)

Norin-sho Sanshi Shikenjo Hokoku
Norin-sho Sanshi Shikenjo Hokoku (Bulletin of the Sericultural Experiment Station) (Japan)

Norsk Geol. Tidsskr.
Norsk Geologisk Tidsskrift (Norway)

North-West Dent.
North-West Dentistry (U.S.)

Northwest Sci.
Northwest Science (U.S.)

Notas Fis., Cent. Brasil. Pesqui. Fis.
Notas de Fisica, Centro Brasileiro de Pesquisas Fisicas (Brazil)

No To Shinkei
No To Shinkei (Brain and Nerve) (Japan)

Nouv. Rev. Franc. Hematol.
Nouvelle Revue Francaise d'Hematologie. (France)

Nowotwory
Nowotwory (Poland)

NTZ-Nachrtech. Z.
NTZ-Nachrichtentechnische Zeitschrift (West Germany)

Nucl. Appl.
Nuclear Applications (U.S.)
Changed to Nuclear Applications and Technology with vol. 7, no. 1, July 1969

Nucl. Appl. Technol.
Nuclear Applications and Technology (Formerly Nuclear Applications) (U.S.)

Nucl. Data, Sect. A
Nuclear Data, Section A (U.S.)

Nucl. Data, Sect. B
Nuclear Data, Section B (U.S.)

Nucl. Energy
Nuclear Energy (Formerly Nuclear Energy Engineer) (England)

Nucl. Eng.
Nuclear Engineering Incorporating Nuclear Power (England)
Superseded by Nuclear Engineering International

Nucl. Eng. Bull.
Nuclear Engineering Bulletin (U.S.)

Nucl. Eng. Design
Nuclear Engineering and Design (Formerly Nuclear Structural Engineering) (Netherlands)

Nucl. Eng. Int.
Nuclear Engineering International Incorporating Nuclear Power (Formerly Nuclear Engineering) (England)

Nucleus (Calcutta)
Nucleus (Calcutta) (India)

Nucleus (Lahore)
Nucleus (Lahore) (Pakistan)

Nucleus (Paris)
Nucleus. La Revue Scientifique a l'Age Atomique (Paris) (France)

Nucl. Fusion
Nuclear Fusion (Journal of Plasma Physics and Thermonuclear Fusion) (Austria)

Nucl. Hematol. (Publ. Nucl. Energy)
Nuclear Hematology, Nuclear, Space and General Hematology, Blood Clotting, Immuno-Hematology (Published In Nuclear Energy) (England)

Nucl. Ind.
Nuclear Industry (U.S.)

Nucl. Instrum. Methods
Nuclear Instruments and Methods (Formerly Nuclear Instruments) (Netherlands)

Nucl. Law Bull.
Nuclear Law Bulletin (Belgium)

Nucl. Law Bull., Suppl.
Nuclear Law Bulletin, Supplement (Belgium)

Nucl.-Med.
Nuclear-Medizin (West Germany)

Nucl. Met., Met. Soc. AIME
Nuclear Metallurgy, Metallurgical Society of AIME (American Institute of Mining, Metallurgical and Petroleum Engineers) (U.S.)

Nucl. News
Nuclear News (U.S.)

Nucl. Newslett. Switz.
Nuclear Newsletter from Switzerland (Switzerland)

Nucl. Phys., A
Nuclear Physics, A (Netherlands)

Nucl. Phys., B
Nuclear Physics, B (Netherlands)

Nucl. Safety
Nuclear Safety (A Bimonthly Technical Progress Review) (U.S.)

Nucl. Sci. Appl.
Nuclear Science and Applications (Pakistan)
Divided into Series A and B

Nucl. Sci. Appl., Ser. A
Nuclear Science and Applications, Series A (Pakistan)

Nucl. Sci. Appl., Ser. B
Nuclear Science and Applications, Series B (Pakistan)

Nucl. Sci. Eng.
Nuclear Science and Engineering (U.S.)

Nucl. Sci. J. (Taiwan)
Nuclear Science Journal (Taiwan) (Ho Tsu K'o Hsueh) (China)

Nukl. Energ.
Nuklearna Energija (Yugoslavia)

Nukleonik
Nukleonik (West Germany)
Discontinued with vol. 12

Nukleonika
Nukleonika (Poland)

Nunt. Radiol.
Nuntius Radiologicus (Italy)

Nuovi Ann. Ig. Microbiol.
Nuovi Annali d'Igiene e Microbiologia (Italy)

XUM

Nuovo Cim.
Nuovo Cimento, Il (Italy)
Superseded by Nuovo Cimento, Il, A and B

Nuovo Cim., A
Nuovo Cimento, Il, A (Italy)

Nuovo Cim., B
Nuovo Cimento, Il, B (Italy)

Nuovo Cim., Suppl.
Nuovo Cimento, Il, Supplemento (Italy)
Superseded by Rivista del Nuovo Cimento

Nursing Times
Nursing Times (England)

N. Y. J. Dent.
New York Journal of Dentistry, The (U.S.)

N. Y. State J. Med.
New York State Journal of Medicine. (U.S.)

Nytt Mag. Zool.
Nytt Magasin for Zoologi (Norway)

Nyu Fudo Indasutori
Nyu Fudo Indasutori (New Food Industry) (Japan)

N. Z. J. Sci.
New Zealand Journal of Science (New Zealand)

N. Z. Med. J.
New Zealand Medical Journal (New Zealand)

O

Oak Ridge Nat. Lab. Rev.
Oak Ridge National Laboratory Review (U.S.)

Obogashch. Rud
Obogashchenie Rud (U.S.S.R.)

Obstet. Gynecol.
Obstetrics and Gynecology. (U.S.)

Ocean Eng.
Ocean Engineering (U.S.)

Oceanol. Int.
Oceanology International (U.S.)

Oceanology (USSR) (Engl. Transl.)
Oceanology (USSR) (English Translation of Okeanologiya) (U.S.)

Oceanus
Oceanus (U. S.)

Odontol. Revy
Odontologisk Revy (Sweden)

Odontol. Tidskr.
Odontologisk Tidskrift (Sweden)

OECD (Organ. Econ. Coop. Develop.) Observ.
OECD (Organization for Economic Cooperation and Development) Observer (France)

Oesterr. Akad. Wiss. Math.-Naturwiss. Kl., Anz.
Oesterreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Anzeiger (Austria)

Oesterr. Akad. Wiss., Math.-Naturwiss. Kl., Sitzungsber., Abt. II
Oesterreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Sitzungsberichte, Abteilung II (Austria)

Oesterr. Bot. Z.
Oesterreichische Botanische Zeitschrift (Austria)

Oesterr. Chem.-Ztg.
Oesterrichische Chemiker-Zeitung (Austria)
Ceased Publication, 1967

Oftal'mol. Zh.
Oftal'mologicheskii Zhurnal (Ukrainian S.S.R.)

Ogneupory
Ogneupory (U.S.S.R.)
Issued in English Translation as Refractories (USSR)

Ohio J. Sci.
Ohio Journal of Science, The (U.S.)

Ohm (Elec. Mag.)
Ohm (The Electrical Magazine Ohm) (Japan)

Oikos
Oikos, Acta Oecologica Scandinavica (Denmark)

Oil Gas J.
Oil and Gas Journal, The (U.S.)

Oita-ken Onsen Chosa Hokoku-syo
Oita-ken Onsen Chosa Hokoku-syo (Japan)

Oita-ken Onsen Chosa Kenkyu-kai Hokoku
Oita-ken Onsen Chosa Kenkyu-kai Hokoku (Japan)

Okayama Daigaku Nogabuku Gakujutsu Hokoku
Okayama Daigaku Nogabuku Gakujutsu Hokoku (Scientific Reports of the Faculty of Agriculture, Okayama University) (Japan)

Okayama Daigaku Onsen Kenkyusho Hokoku
Okayama Daigaku Onsen Kenkyusho Hokoku (Papers of the Inst. for Thermal Spring Research, Okayama University) (Japan)

Okayama Igakkai Zasshi
Okayama Igakkai Zasshi (Journal of the Okayama Medical Society) (Japan)

Okeanologiya
Okeanologiya (U.S.S.R.)

Oleagineux
Oleagineux (France)

Oncology
Oncology (Formerly Oncologia) (Switzerland)

Oncol. Radiol.
Oncologia si Radiologia (Romania)

Onde Elec.
Onde Electrique, L (France)

Onderstepoort J. Vet. Res.
Onderstepoort Journal of Veterinary Research (South Africa)

Onken Kiyo
Onken Kiyo (The Bulletin of the Institute of Balneotherapeutics Kyushu University) (Japan)

Onsen Kagaku
Onsen Kagaku (Journal of tne Balneological Society of Japan) (Japan)

Onsen Kogakkaishi
Onsen Kogakkaishi (Journal of the Society of Engineers for Mineral Springs, Japan) (Japan)

Ont. Hydro Res. News
Ontario Hydro Research News (Canada)
Changed to Ontario Hydro Research Quarterly

Ont. Hydro Res. Quart.
Ontario Hydro Research Quarterly (Canada)
Supersedes Ontario Hydro Research News

Oper. Res.
Operations Research (U.S.)

Ophthalmologica
Ophthalmologica. International Journal of Ophthalmology (Switzerland)

Opt. Acta
Optica Acta. International Journal of Optics. (England)

Opt. Commun.
Optics Communications (Netherlands)

Optik
Optik. Zeitschrift fuer das Gesamte Gebeit der Licht-und Elektronenoptik (West Germany)

Opt. Spectra
Optical Spectra (U.S.)

Opt. Spectrosc. (USSR) (Engl. Transl.)
Optics and Spectroscopy (USSR) (English Translation of Optika i Spektroskopiya) (U.S.)

Oral Surg., Oral Med., Oral Pathol.
Oral Surgery, Oral Medicine, Oral Pathology. (U.S.)

Orbis
Orbis. A Quarterly Journal of World Affairs (U.S.)

Organometal. Chem. Rev.
Organometallic Chemistry Reviews (Netherlands)

Org. Magn. Resonance
Organic Magnetic Resonance (England)

Org. Mass Spectrom.
Organic Mass Spectrometry (England)

Ortop., Travmatol. Prot.
Ortopediya, Travmatologiya i Protezirovanie (U.S.S.R.)

Orv. Hetil.
Orvosi Hetilap (Hungary)

Orvostudomany
Orvostudomany (Hungary)

Osaka City Med. J.
Osaka City Medical Journal (Japan)

Osaka Daigaku Igaku Zasshi
Osaka Daigaku Igaku Zasshi (Medical Journal of Osaka University, Japanese Edition) (Japan)

Osaka Daigaku Shigaku Zasshi
Osaka Daigaku Shigaku Zasshi (The Journal of Osaka University Dental Society) (Japan)

Osaka Furitsu Kogyo Shoreikan Hokoku
Osaka Furitsu Kogyo Shoreikan Hokoku (Reports of Industrial Research Inst., Osaka Prefecture) (Japan)

Osaka-Furitsu Koshueisei Kenkyusho Kenkyu Hokoku
Osaka-Furitsu Koshueisei Kenkyusho Kenkyu Hokoku (Proceedings of the Osaka Public Health Institute) (Japan)

Osaka Kogyo Gijutsu Shikenjo Kiho
Osaka Kogyo Gijutsu Shikenjo Kiho (Bulletin of the Government Industrial Research Inst., Osaka) (Japan)

Osaka Shiritsu Daigaku Igaku Zasshi
Osaka Shiritsu Daigaku Igaku Zasshi (The Journal of the Osaka City Medical Center) (Japan)

Otomeshon
Otomeshon (Automation) (Japan)

Oto-Rino-Laringol. Ital.
Oto-Rino-Laringologia Italiana (Italy)

Oxidation Metals
Oxidation of Metals (U. S.)

Oyo Butsuri
Oyo Butsuri (Journal of Applied Physics) (Japan)

P

Pac. J. Math.
Pacific Journal of Mathematics (U.S.)

Pac. Sci.
Pacific Science (U. S.)

Pa. Dent. J.
Pennsylvania Dental Journal (U.S))

Paediat. Grenzgeb.
Paediatrie und Grenzgebiete (East Germany)

Pak. J. Sci. Ind. Res.
Pakistan Journal of Scientific and Industrial Research (Pakistan)

Pak. Med. Rev.
Pakistan Medical Review (Pakistan)

Panminerva Med.
Panminerva Medica (Italy)

Paperboard Packag.
Paperboard Packaging (U.S.)

Pap. Meteorol. Geophys. (Tokyo)
Papers in Meteorology and Geophysics (Tokyo) (Japan)

Pap. Ship Res. Inst. (Jap.)
Papers of Ship Research Institute (Japan)

Parbhani Agr. Coll. Mag.
Parbhani Agricultural College Magazine (India)

Particle Accel.
Particle Accelerators (Scotland)

Pathol.-Biol.
Pathologie-Biologie (France)

Pathol. Eur.
Pathologia Europaea (Belgium)

Pathol. Microbiol.
Pathologia et Microbiologia (Switzerland)

Pathology
Pathology (Australia)

Patol. Fiziol. Eksp. Ter.
Patologicheskaya Fiziologiya i Eksperimentalnaya Terapiya (U.S.S.R.)

Patol. Pol.
Patologia Polska (Poland)

Pediatrics
Pediatrics (U.S.)

Peintures, Pigments, Vernis
Peintures, Pigments, Vernis (France)

Perfum. Essent. Oil Rec.
Perfumery and Essential Oil Record (England)

Pericd. Mineral.
Periodico di Mineralogia (Italy)

Period. Polytech. Chem. Eng.
Periodica Polytechnica. Chemical Engineering. Chemische Ingenieurwesen (Hungary)

Period. Polytech. Elec. Eng.
Periodica Polytechnica. Electrical Engineering (Hungary)

Petrol. Chem. (USSR) (Engl. Transl.)
Petroleum Chemistry (USSR) (English Translation of Neftekhimiya) (U.S.)

Petrol. Geol. (USSR) (Engl. Transl.)
Petroleum Geology (USSR) (English Translation of Geologiya Nefti i Gaza) (U.S.)

Petrol. Geol. Taiwan
Petroleum Geology of Taiwan (China (Taiwan))

Pfluegers Arch. - Eur. J. Physiol.
Pfluegers Archiv - European Journal of Physiology (Formerly Archiv fuer die Gesamte Physiologie des Menschen und der Tiere, Pfluegers) (West Germany)

Pharmazie
Pharmazie, Die (West Germany)

Pharm. Weekbl.
Pharmaceutisch Weekblad (Netherlands)

Philipp. J. Intern. Med.
Philippine Journal of Internal Medicine (Philippines)

Philipp. Nucl. J.
Philippine Nuclear Journal (Philippines)

Philips Res. Rep.
Philips Research Reports (Netherlands)

Philips Res. Rep. Suppl.
Philips Research Reports Supplements (Netherlands)

Philips Tech. Rev.
Philips Technical Review (Netherlands)

Phil. Mag.
Philosophical Magazine, The (England)

Phil. Trans. Roy. Soc. London, Ser. A
Philosophical Transactions of the Royal Society of London, Series A (England)

Photochem. Photobiol.
Photochemistry and Photobiology (England)

Photogr. Appl. Sci. Technol.
Photographic Applications in Science and Technology (U.S.)

Photophysiol. Curr. Top.
Photophysiology. Current Topics (U.S.)

Phys. Bl.
Physikalische Blaetter (West Germany)

Phys. Bull. (London)
Physics Bulletin (London) (England)

Phys. Chem. Glasses
Physics and Chemistry of Glasses (England)

XUM

Phys. Chem. Liquids
Physics And Chemistry of Liquids (England)

Phys. Earth Planet. Interiors
Physics of the Earth and Planetary Interiors (Netherlands)

Phys. Educ.
Physics Education (England)

Phys. Fluids
Physics of Fluids, The (U.S.)

Phys. Fluids, Suppl.
Physics of Fluids, The, Supplement (U.S.)

Physica
Physica (Netherlands)

Physiol. Behav.
Physiology and Behavior (England)

Physiol. Bohemoslov.
Physiologia Bohemoslovaca (Czechoslovakia)

Physiol. Plant.
Physiologia Plantarum (Denmark)

Physiol. Zool.
Physiological Zoology (U.S.)

Phys. Kondens. Mater.
Physik der Kondensierten Materie (West Germany)

Phys. Lett., A
Physics Letters, (Section) A (Netherlands)

Phys. Lett., B
Physics Letters, (Section) B (Netherlands)

Phys. Med. Biol.
Physics in Medicine and Biology (England)

Phys. Metals Metallogr. (USSR) (Engl. Transl.)
Physics of Metals and Metallography, The (USSR) (English Translation of Fizika Metallov i Metallovadeniya) (England)

Phys. Norv.
Physica Norvegica (Norway)

Phys. Rev.
Physical Review, The (U.S.)
Divided into Sections A, B, C, and D, Beginning Jan. 1970

Phys. Rev., A
Physical Review, The, A. General Physics (U. S.)

Phys. Rev., B
Physical Review, The, B. Solid State (U. S.)

Phys. Rev., C
Physical Review, The, C. Nuclear Physics (U. S.)

Phys. Rev., D
Physical Review, The, D. Particles and Fields (U. S.)

Phys. Rev. Lett.
Physical Review Letters (U.S.)

Phys. Sintering
Physics of Sintering (Yugoslavia)

Phys. Status Solidi
Physica Status Solidi (East Germany)

Phys. Status Solidi (a)
Physica Status Solidi (a). Applied Research (East Germany)

Phys. Today
Physics Today (U.S.)

Phytochemistry
Phytochemistry (England - U.S.)

Phytopathology
Phytopathology. An International Journal (U.S.)

Planet. Space Sci.
Planetary and Space Science (England)

Planseeber. Pulvermet.
Planseeberichte fuer Pulvermetallurgie Vereinigt mit Powder Metallurgy Bulletin (Austria)

Planta
Planta. (West Germany)

Plant Cell Physiol. (Tokyo)
Plant and Cell Physiology (Tokyo) (Japan)

Plant Dis. Rep.
Plant Disease Reporter (U.S.)

Plant Physiol.
Plant Physiology (U.S.)

Plant Soil
Plant and Soil (Netherlands)

Plasma Phys.
Plasma Physics (Formerly Journal of Nuclear Energy, Part C. Plasma Physics-Accelerators-Thermonuclear Research) (England)

Plaste Kaut.
Plaste und Kautschuk mit Fachteil Anstrichstoffe (East Germany)

Plast. Massy
Plasticheskie Massy (U.S.S.R.)
Issued in English Translation as Soviet Plastics

Plast. Reconstr. Surg.
Plastic and Reconstructive Surgery and the Transplantation Bulletin (U.S.)

Plating
Plating (U.S.)

Platinum Metals Rev.
Platinum Metals Review (England)

Pochvovedenie
Pochvovedenie (U.S.S.R.)
For English Translation see Soviet Soil Science

Pokroky Mat. Fys. Astron.
Pokroky Matematiky, Fysiky a Astronomie (Czechoslovakia)

Pokroky Praskove Met. VUPM
Pokroky Praskove Metalurgie VUPM (Vyzkumny Ustav pro Praskovou Metalurgii) (Czechoslovakia)

Pol. Arch. Med. Wewn.
Polskie Archiwum Medycyny Wewnetrznej (Poland)

Polarforschung
Polarforschung (West Germany)

Pol. Med. J.
Polish Medical Journal (Translation of Articles, from Various Medical Journals) (Poland)

Pol. Przegl. Radiol. Med. Nukl.
Polski Przeglad Radiologii i Medycyny Nuklearnej (Poland)
Issued in English Translation as Polish Review of Radiology and Nuclear Medicine

Pol. Rev. Radiol. Nucl. Med.
Polish Review of Radiology and Nuclear Medicine (English Translation of Polski Przeglad Radiologii i Medycyny Nuclearnej) (Poland)

Pol. Tyg. Lek.
Polski Tygodnik Lekarski (Poland)

Polymer
Polymer (England)

Pomiary, Automat., Kontr.
Pomiary, Automatika, Kontrola (Poland)

Pororogurafii
Pororogurafii (Review of Polarography) (Japan)

Porosh. Met., Akad. Nauk Ukr. SSR
Poroshkovaya Metallurgiya, Akademiya Nauk Ukrainskoi SSR (Ukrainian S.S.R.)
For English Translation see Soviet Powder Metallurgy and Metal Ceramics

Port. Phys.
Portugaliae Physica (Portugal)

Postepy Astron.
Postepy Astronomii (Poland)

Postepy Biochem.
Postepy Biochemii (Poland)

Postepy Fiz.
Postepy Fizyki (Poland)

Postepy Nauk Roln.
Postepy Nauk Rolniczych (Poland)

Postgrad. Med.
Postgraduate Medicine (U.S.)

Postgrad. Med. J.
Postgraduate Medical Journal (England)

Poultry Sci.
Poultry Science (U.S.)

Powder Met.
Powder Metallurgy (England)

Powder Technol.
Powder Technology (Netherlands)

Powder Technol. (Tokyo)
Powder Technology (Tokyo) (Japan)

Power
Power with which are Consolidated Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer, and Operating Engineer (U.S.)

Power Eng.
Power Engineering (U.S.)

Poznan. Tow. Przyj. Nauk Pr. Kom. Mat.-Przyr.
Poznanskie Towarzystwo Przyjaciol Nauk Prace Komisji Matematyczno-Przyrodniczej (Poland)

Prac. Lek.
Pracovni Lekarstvi (Czechoslovakia)

Practitioner
Practitioner, The (England)

Prakt. Akad. Athenon
Praktika tes Akademias Athenon (Greece)

Prakt. Metallog.
Praktische Metallographie (West Germany)

Praxis (Bern)
Praxis (Bern) (Switzerland)

Pr. Cent. Inst. Ochrony Pracy
Prace Centralnego Instytutu Ochrony Pracy (Poland)

Precis. Metal
Precison Metal (Formerly Precision Metal Molding) (U.S.)

Precis. Metal Molding
Precision Metal Molding (U.S.)

Presse Med.
Presse Medicale, La (France)

Prib. Sist. Upr.
Pribory i Sistemy Upravleniya (U.S.S.R.)

Prib. Tekh. Eksp.
Pribory i Tekhnika Eksperimenta (U.S.S.R.)
For English Translation see Instruments and Experimental Techniques (USSR)

Prikl. Geofiz.
Prikladnaya Geofizika (U.S.S.R.)

Prikl. Mat. Mekh.
Prikladnaya Matematika i Mekhanika (U.S.S.R.)
Issued in English Translation as Journal of Applied Mathematics and Mechanics (USSR)

Prikl. Mekh.
Prikladnaya Mekhanika (Ukrainian S.S.R.)

Pr. Inst. Masz. Przeply.
Prace Instytutu Maszyn Przeplywowych (Poland)

Priroda
Priroda (U.S.S.R.)

Pr. Nauk. Inst. Ochr. Rosl.
Prace Naukowe Instytutu Ochrony Roslin (Poland)

Probl. Endokrinol.
Problemy Endokrinologii (Formerly Problemy Endokrinologii i Gormonoterapii) (U.S.S.R.)

Probl. Endokrinol. Gormonoter.
Problemy Endokrinologii i Gormonoterapii (U.S.S.R.)
Superseded by Problemy Endokrinologii (U.S.S.R.)

Probl. Gematol. Pereliv. Krovi
Problemy Gematologii i Perelivaniya Krovi (U.S.S.R.)
Issued in English Translation as Problems of Hematology and Blood Transfusion (USSR)

Probl. Kosm. Biol.
Problemy Kosmicheskoi Biologii (U.S.S.R.)

Probl. Prochnosti
Problemy Prochnosti (U.S.S.R.)

Probl. Sovrem. Khim. Koord. Soedin., Leningrad. Gos. Univ.
Problemy Sovremennoi Khimii Koordinatsionnykh Soedinenii, Leningradskii Gosudarstvennyi Universitet Imeni A. A. Zhdanova (U.S.S.R.)

Probl. Teor. Gravitatsii Elem. Chastits
Problemy Teorii Gravitatsii i Elementarnykh Chastits (U.S.S.R.)

Proc. Amer. Ass. Cancer Res.
Proceedings of the American Association for Cancer Research (U.S.)

Proc. Amer. Power Conf.
Proceedings of the American Power Conference (U.S.)

Proc. Amer. Soc. Hort. Sci.
Proceedings of the American Society for Horticultural Science (U.S.)

Proc., Annu. Tech. Meet., Int. Metallogr. Soc., Inc.
Proceedings, Annual Technical Meeting, International Metallographic Society, Inc. (U.S.)

Proc. Astron. Soc. Aust.
Proceedings of the Astronomical Society of Australia (Australia)

Proc. Aust. Ass. Neurol.
Proceedings of the Australian Association of Neurologists (Australia)

Proc. Aust. Soc. Med. Res.
Proceedings of the Australian Society of Medical Research (Australia)

Proc. Brit. Ceramic Soc.
Proceedings of the British Ceramic Society (England)

Proc. Cambridge Phil. Soc.
Proceedings of the Cambridge Philosophical Society (England)

Proc. Fac. Sci. Tokai Univ.
Proceedings of the Faculty of Science of Tokai University (Japan)

Proc. Fla. State Hort. Soc.
Proceedings of the Florida State Horticultural Society (U.S.)

Proc. Fujihara Mem. Fac. Eng., Keio Univ. (Tokyo)
Proceedings of the Fujihara Memorial Faculty of Engineering, Keio University (Tokyo) (Japan)

Proc. Helminthol. Soc. Wash., D. C.
Proceedings of the Helminthological Society of Washington, D. C. (U.S.)

Proc. Jap. Soc. Reticuloendothel. Syst.
Proceedings of the Japan Society of the Reticuloendothelial System (Japan)

Proc. IEEE (Inst. Elec. Electron. Eng.)
Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) (Formerly Proceedings of the Institute of Radio Engineers) (U.S.)

Proc. Indian Acad. Sci., Sect. A
Proceedings of the Indian Academy of Sciences, Section A (India)

Proc. Indian Acad. Sci., Sect. B
Proceedings of the Indian Academy of Sciences, Section B (India)

Proc. Inst. Civil Eng. (London)
Proceedings of the Institution of Civil Engineers (London) (England)

Proc. Inst. Elec. Eng. (London)
Proceedings of the Institution of Electrical Engineers, The (London) (England)

Proc. Inst. Mech. Eng. (London)
Proceedings of the Institution of Mechanical Engineers (London) (England)

XUM

Proc. Inst. Med. Chicago
Proceedings of the Institute of Medicine of Chicago (U.S.)

Proc. Iowa Acad. Sci.
Proceedings of the Iowa Academy of Science (U.S.)

Proc. Jap. Acad.
Proceedings of the Japan Academy (Japan)

Proc. Jap. Conf. Radioisotop.
Proceedings of the Japan Conference on Radioisotopes (Japan)

Proc. Jap. Soc. Civil Engg.
Proceedings of the Japan Society of Civil Engineers (Japan)

Proc. La. Acad. Sci.
Proceedings of the Louisiana Academy of Sciences, The (U.S.)

Proc. Nat. Acad. Sci. U. S. A.
Proceedings of the National Academy of Sciences of the United States of America (U.S.)

Proc. Nat. Inst. Sci. India, Part A
Proceedings of the National Institute of Sciences of India. Part A (India)

Proc. Nat. Inst. Sci. India, Part A, Suppl.
Proceedings of the National Institute of Sciences of India, Part A, Supplement (India)

Proc. Nat. Inst. Sci. India, Part B
Proceedings of the National Institute of Sciences of India. Part B (India)

Proc. Nucl. Phys. Solid State Phys. Symp.
Proceedings of the Nuclear Physics and Solid State Physics Symposium (India)

Proc. Nutr. Soc.
Proceedings of the Nutrition Society (England)

Proc. Rel. Maint. Conf.
Proceedings of Reliability and Maintainability Conference (U.S.)

Proc. Res. Inst. Atmos., Nagoya Univ.
Proceedings of the Research Inst. of Atmospherics, Nagoya University (Japan)

Proc. Res. Inst. Nucl. Med. Biol.
Proceedings of Research Institute for Nuclear Medicine and Biology (Japan)

Proc. Robert A. Welch Found. Conf. Chem. Res.
Proceedings of the Robert A. Welch Foundation Conferences on Chemical Research (U.S.)

Proc. Roy. Aust. Chem. Inst.
Proceedings of The Royal Australian Chemical Institute (Australia)

Proc. Roy. Inst. Gt. Brit.
Proceedings of the Royal Institution of Great Britain (England)

Proc. Roy. Irish Acad., Sect. A
Proceedings of the Royal Irish Academy, Section A (Ireland)

Proc. Roy. Soc. (London), Ser. A
Proceedings of the Royal Society (London), Series A (England)

Proc. Roy. Soc. (London), Ser. B
Proceedings of the Royal Society (London), Series B (England)

Proc. Roy. Soc. Med.
Proceedings of the Royal Society of Medicine (England)

Proc. Soc. Anal. Chem.
Proceedings of the Society for Analytical Chemistry (England)

Proc. Soc. Exp. Biol. Med.
Proceedings of the Society for Experimental Biology and Medicine (U.S.)

Proc. Univ. Otago Med. Sch.
Proceedings of the University of Otago Medical School (New Zealand)

Proc. West. Pharmacol. Soc.
Proceedings of the Western Pharmacology Society (U.S.)

Prod. Finish. (Cincinnati)
Products Finishing (Cincinnati) (U.S.)

Progr. Aeronaut. Sci.
Progress in Aeronautical Science (U.S.)

Progr. Allergy
Progress in Allergy Fortschritte der Allergielehre (Switzerland)

Progr. Astronaut. Aeronaut.
Progress in Astronautics and Aeronautics (Formerly Progress in Astronautics and Rocketry) (U.S.)

Progr. Brain Res.
Progress in Brain Research (Netherlands)

Progr. Chem. Toxicol.
Progress in Chemical Toxicology (U.S.)

Progr. Clin. Cancer
Progress in Clinical Cancer (U. S.)

Progr. Clin. Pathol.
Progress in Clinical Pathology (U.S.)

Progr. Exp. Tumor Res.
Progress in Experimental Tumor Research (Switzerland)

Progr. Hematol.
Progress in Hematology (U.S.)

Progr. High Temp. Phys. Chem.
Progress in High Temperature Physics and Chemistry (England)

Progr. Mater. Sci.
Progress in Materials Science (England)

Progr. Med. Virol.
Progress in Medical Virology (Switzerland)

Progr. Neurol. Psychiat.
Progress in Neurology and Psychiatry (U. S.)

Progr. Nucl. Energy, Ser. III
Progress in Nuclear Energy, Series III (England-U.S.)

Progr. Nucl. Energy, Ser. IX
Progress in Nuclear Energy, Series IX (England-U.S.)

Progr. Nucl. Magn. Resonance Spectrosc.
Progress in Nuclear Magnetic Resonance Spectroscopy (England)

Progr. Nucl. Phys.
Progress in Nuclear Physics (England)

Progr. Pediat. Radiol.
Progress in Pediatric Radiology (Switzerland)

Progr. Sci. Technol. Rare Earths
Progress in the Science and Technology of the Rare Earths (England)

Progr. Separ. Purif.
Progress in Separation and Purification (U.S.)

Progr. Theor. Phys. (Kyoto)
Progress of Theoretical Physics (Kyoto) (Japan)

Progr. Theor. Phys. (Kyoto), Suppl.
Progress of Theoretical Physics (Kyoto), Supplement (Japan)

Prom. Arm., Sov. Nar. Khoz. Arm. SSR, Tekh.-Ekon. Byull.
Promyshlennost Armenii, Sovet Narodnogo Khozyaistva Armyanskoi SSR, Tekhniko-Ekonomicheskii Byulleten (Armenian S.S.R.)

Prot. Civ. Secur. Ind.
Protection Civile et Securite Industrielle (France)

Protoplasma
Protoplasma (Austria)

Prum. Potravin
Prumysl Potravin (Czechoslovakia)

Przegl. Budowlany
Przeglad Budowlany (Poland)

Przegl. Dermatol.
Przeglad Dermatologiczny (Poland)

Przegl. Elektron.
Przeglad Elektroniki (Poland)

Przegl. Geofiz.
Przeglad Geofizyczny (Poland)

Przegl. Lek.
Przeglad Lekarski (Poland)

Przegl. Skorzany
Przeglad Skorzany (Poland)

Przem. Spozyw.
Przemysl Spozywczy (Poland)

PTB Mitt.
PTB Mitteilungen. Amts- und Mitteilungsblatt der Physikalisch-Technischen Bundesanstalt (West Germany)

Publ. Amer. Ass. Advan. Sci.
Publication of the American Association for the Advancement of Science (U.S.)

Publ. Astron. Soc. Pac.
Publications of the Astronomical Society of the Pacific (U.S.)

Publ. Dominion Observ., Ottawa
Publications of the Dominion Observatory, Ottawa (Canada)

Publ. Elektroteh. Fak. Univ. Beogradu, Ser. Mat. Fiz.
Publikacije Elektrotehnickog Fakulteta Univerziteta u Beogradu, Serija Matematika i Fizika (Yugoslavia)

Public Health Rep. (U.S.)
Public Health Reports (U.S.)

Publ. Museu Lab. Mineral. Geol. Univ. Coimbra Centro Estud. Geol., Mem. Notic.
Publicacoes do Museu e Laboratorio Mineralogico e Geologico da Universidade de Coimbra e do Centro de Estudos Geologico, Memorias e Noticias (Portugal)

Pub. Util. Fortn.
Public Utilities Fortnightly (U.S.)

Pure Appl. Chem.
Pure and Applied Chemistry (The Official Journal of the International Union of Pure and Applied Chemistry) (England)

Pure Appl. Geophys.
Pure and Applied Geophysics (Formerly Geofisica Pura e Applicata) (Switzerland)

Q

Quad. Nutr.
Quaderni della Nutrizione (Italy)

Quad. Radiol.
Quaderni di Radiologia (Italy)

Quart. Appl. Math.
Quarterly of Applied Mathematics (U.S.)

Quart. Colo. Sch. Mines
Quarterly of the Colorado School of Mines (U.S.)

Quart J., Fla. Acad. Sci.
Quarterly Journal, Florida Academy of Sciences (U.S.)

Quart. J. Geol., Mining Met. Soc. India
Quarterly Journal of the Geological, Mining and Metallurgical Society of India (India)

Quart. J. Geol. Soc. London
Quarterly Journal of the Geological Society of London (England)

Quart. J. Mech. Appl. Math.
Quarterly Journal of Mechanics and Applied Mathematics (England)

Quart. J. Roy. Astron. Soc.
Quarterly Journal of the Royal Astronomical Society, The (England)

Quart. J. Roy. Meteorol. Soc.
Quarterly Journal of the Royal Meteorological Society (England)

Quart. Rev. Biophys.
Quarterly Reviews of Biophysics (England)

Quart. Rev., Chem. Soc.
Quarterly Reviews, Chemical Society (London) (England)

Queensland Nurses J.
Queensland Nurses Journal (Australia)

R

Radar (Prague)
Radar (Prague) (Czechoslovakia)

Radex Rundsch.
Radex Rundschau (Austria)

Radiat. Bot.
Radiation Botany (England)

Radiat. Eff.
Radiation Effects (England)

Radiat. Res.
Radiation Research (U.S.)

Radiat. Res. Rev.
Radiation Research Reviews (Netherlands)

Radiaz. Alta Energ.
Radiazioni di Alta Energia (Italy)

Radiobiologiya
Radiobiologiya (U.S.S.R.)
Issued in English Translation as Radiobiology (USSR)

Radiobiol. Radioter. Fis Med.
Radiobiologia, Radioterapia e Fisica Medica (Formerly Radioterapia, Radiobiologia e Fisica Medica) (Italy)

Radiochem. Radioanal. Lett.
Radiochemical and Radioanalytical Letters (Switzerland - Hungary)

Radiochim. Acta
Radiochimica Acta (West Germany)

Radiographer
Radiographer (Australia)

Radiography
Radiography (England)

Radioisotopes (Tokyo)
Radioisotopes (Tokyo) (Japan)

Radioisotopy
Radioisotopy (Czechoslovakia)

Radiokhimiya
Radiokhimiya (U.S.S.R.)
Issued in English Translation as Soviet Radiochemistry

Radiol. Aust.
Radiologia Austriaca (Austria)
Ceased Publication

Radiol. Clin. Biol.
Radiologia Clinica et Biologica (Formerly Radiologia Clinica) (Switzerland)

Radiol. Diagn.
Radiologia Diagnostica (East Germany)

Radiol. Health Data Rep.
Radiological Health Data and Reports (Formerly Radiological Health Data) (U.S.)

Radiol. Med.
Radiologia Medica, La (Italy)

Radiologe
Radiologe (West Germany)

Radiologia (Panama)
Radiologia (Panama)

Radiology
Radiology (U.S.)

Radiol. Technol.
Radiologic Technology (Formerly X-Ray Technician) (U.S.)

Radioprotection
Radioprotection. Bulletin de la Societe Francaise de Radioprotection (France)

Radio Sci.
Radio Science (Formerly Journal of Research of the National Bureau of Standards, D) (U.S.)

XUM

Radiotekh. Elektron.
Radiotekhnika i Elektronika (U.S.S.R.)
Issued in English Translation as Radio Engineering and Electronic Physics (USSR)

Rame
Rame (Italy)

Rass. Trim. Odontoiat.
Rassegna Trimestrale di Odontoiatrica (Italy)

Raumfahrtforschung
Raumfahrtforschung (Formerly Raketentechnik und Raumfahrtforschung) (West Germany)

Razved. Geofiz.
Razvedochnaya Geofizika (U.S.S.R.)

RCA Rev.
RCA Review (U.S.)

RCN (Reactor Cent. Ned.) Meded.
RCN (Reactor Centrum Nederland) Mededeling (Netherlands)

Reactor
Reactor (England)

Reactor Fuel-Process. Technol.
Reactor and Fuel-Processing Technology (A Quarterly Technical Progress Review) (Formerly Power Reactor Technology and Reactor Fuel Processing) (U.S.)
Superseded by Reactor Technology

Reactor Mater.
Reactor Materials. (A Quarterly Technical Progress Review) (Formerly Reactor Core Materials) (U.S.)

Reactor Technol.
Reactor Technology. A Quarterly Technical Progress Review (Formerly Reactor Fuel-Processing Technology) (U.S.)

Reakts. Sposobnost Org. Soedin., Tartu. Gos. Univ.
Reaktsionnaya Sposobnost Organicheskikh Soedinenii, Tartuskii Gosudarstvennyi Universitet (Estonian S.S.R.)
Issued in English Translation as Organic Reactivity

Rec. Chem. Progr.
Record of Chemical Progress (U.S.)

Recenti Progr. Med.
Recenti Progressi in Medicina (Italy)

Rech. Aerosp.
Recherche Aerospatiale (France)

Rec. Trav. Chim.
Recueil des Travaux Chimiques des Pays-Bas (Netherlands)

Rend. Ist. Lombardo Sci. Lett., A
Rendiconti dell'Istituto Lombardo di Scienze e Lettere, A Scienze Matematiche, Fisiche, Chimiche e Geologiche (Italy)

Rend. Semin. Mat. Fis. Milano
Rendiconti del Seminario Matematico e Fisico di Milano (Italy)

Rentgenol. Radiol.
Rentgenologiya i Radiologiya (Bulgaria)

Rep. Cast. Res. Lab., Waseda Univ.
Report of the Castings Research Laboratory, Waseda University (Japan)

Rep. Inst. Ind. Sci., Univ. Tokyo
Report of the Institute of Industrial Science, University of Tokyo (Japan)

Rep. Ionosphere Space Res. Jap.
Report of Ionosphere and Space Research in Japan (Japan)

Rep. Prefect. Ind. Res. Inst., Shizuoka
Reports of the Prefectural Industrial Research Institute, Shizuoka (Japan)

Rep. Progr. Appl. Chem.
Reports on the Progress of Applied Chemistry (England)

Rep. Progr. Phys.
Reports on Progress in Physics (England)

Rep. Res. Inst. Appl. Mech. (Kyushu Univ.)
Report of the Research Institute for Applied Mechanics (Kyushu University) (Japan)

Repules
Repules (Hungary)

Res. Bull., Univ. Calcutta
Research Bulletin, University of Calcutta (India)

Research (London)
Research (London) (Supersedes Research Techniques and Instrumentation) (England)

RES, J. Reticuloendothel. Soc.
RES, Journal of the Reticuloendothelial Society (U.S.)

Respiration
Respiration, International Review of Thoracic Diseases (Formerly Medicina Thoracalis) (Switzerland)

Respiration, Suppl.
Respiration, Supplement (Switzerland)

Res. Rep. Lab. Nucl. Sci., Tohoku Univ.
Research Report of the Laboratory of Nuclear Science, Tohoku University (Japan)

Res. Rev. (Office Aerosp. Res.)
Research Review (Office of Aerospace Research) (U.S.)

Rev. Agr. (Brussels)
Revue de l'Agriculture (Brussels) (Belgium)

Rev. Alumin.
Revue de l'Aluminium (France)
Changed to Revue de Aluminum et de Ses Applications in 1969

Rev. A.T.B. Met.
Revue A.T.B. Metallurgie (Belgium)

Rev. Brasil. Odontol.
Revista Brasileira de Odontologia (Brazil)

Rev. Can. Biol.
Revue Canadienne de Biologie (Canada)

Rev. Chim. (Bucharest)
Revista de Chimie (Bucharest) (Romania)

Rev. Chim. Miner.
Revue de Chimie Minerale (France)

Rev. Clin. Espan.
Revista Clinica Espanola (Spain)

Rev. Corps Sante Armees
Revue des Corps de Sante des Armees (France)

Rev. Dent. Liban.
Revue Dentaire Libanaise (Lebanon)

Rev. Elevage Med. Vet. Pays Trop.
Revue d'Elevage et de Medecine Veterinaire des Pays Tropicaux (France)

Rev. Espan. Fisiol.
Revista Espanola de Fisiologia (Spain)

Rev. Fr. Elec.
Revue Francaise de l'Electricite (France)

Rev. Fr. Endocrinol. Clin., Nutr. Metab.
Revue Francaise d'Endocrinologie Clinique, Nutrition et Metabolism (France)

Rev. Fr. Energ.
Revue Francaise de l'Energie (France)

Rev. Fr. Etud. Clin. Biol.
Revue Francaise d'Etudes Cliniques et Biologiques (France)
Changed to Revue Europeenne d'Etudes Cliniques et Biologiques

Rev. Gen. Caout. Plast.
Revue Generale des Caoutchoucs et Plastiques (France)

Rev. Gen. Elec.
Revue Generale de l'Electricite (France)

Rev. Gen. Therm.
Revue Generale de Thermique (France)

Rev. Geogr. Phys. Geol. Dyn.
Revue de Geographie Physique et de Geologie Dynamique (France)

Rev. Geophys.
Reviews of Geophysics (U.S.)

Rev. Geophys. Space Phys.
Reviews of Geophysics and Space Physics (U. S.)
Supersedes Reviews of Geophysics

Rev. Hautes Temp. Refract.
Revue des Hautes Temperatures et des Refractsrires (France)

Rev. H. F. (Brussels)
Revue H. F. (Brussels) (Belgium)

Rev. Hort. Viticult.
Revista de Horticultura si Viticultura (Romania)

Rev. Iber. Endocrinol.
Revista Iberica de Endocrinologia (Supersedes Acta Endocrinologica Iberica) (Spain)

Rev. Ind. Minerale
Revue de l'Industrie Minerale (France)

Rev. Inst. Fr. Petrole Ann. Combust. Liquides
Revue de l'Institut Francais du Petrole et Annales des Combustions Liquides (France)

Rev. Inst. Med. Trop. Sao Paulo
Revista do Instituto de Medicina Tropical de Sao Paulo (Brazil)

Rev. Int. Hautes Temp. Refract.
Revue Internationale des Hautes Temperatures et des Refractaires (Formerly Revue des Hautes Temperatures et des Refractaires) (France)

Rev. Int. Oceanogr. Med.
Revue Internationale d'Oceanographie Medicale (France)

Rev. Int. Serv. Sante Armees Terre Mer Air
Revue Internationale des Services de Santa des Armees de Terre de Mer et de l'Air (Belgium)

Rev. Juridica Cataluna
Revista Juridica de Cataluna (Spain)

Rev. Med.-Chir. (Iasi)
Revue Medico-Chirurgicale (Iasi) (Romania)

Rev. Med. Liege, Suppl.
Revue Medicale de Liege, Supplement (Belgium)

Rev. Med. Suisse Romande
Revue Medicale de la Suisse Romande (Switzerland)

Rev. Med. Vet. (Toulouse)
Revue de Medecine Veterinaire (Toulouse) (France)

Rev. Met. (Madrid)
Revista de Metalurgia (Madrid) (Spain)

Rev. Met. (Paris)
Revue de Metallurgie (Paris) (France)

Rev. Mex. Fis.
Revista Mexicana de Fisica (Mexico)

Rev. Minelor (Bucharest)
Revista Minelor (Bucharest) (Romania)

Rev. Mod. Phys.
Reviews of Modern Physics (U.S.)

Rev. Pathol. Comp. Med. Exp.
Revue de Pathologie Comparee et de Medecine Experimentale (Formerly Revue de Pathologie Comparee) (France)

Rev. Patronato Biol. Anim.
Revista del Patronato de Biologia Animal (Spain)

Rev. Phys. Appl.
Revue de Physique Appliquee (Supplement au Journal de Physique) (France)

Rev. Port. Quim. (Lisbon)
Revista Portuguesa de Quimica (Lisbon) (Portugal)

Rev. Quest. Sci.
Revue des Questions Scientifiques (Belgium)

Rev. Real Acad. Cienc. Exact., Fis. Nat. Madrid
Revista de la Real Academia de Ciencias Exactas, Fisicas y Naturales de Madrid (Spain)

Rev. Roum. Biochim.
Revue Roumaine de Biochimie (Romania)

Rev. Roum. Biol., Ser. Bot.
Revue Roumaine de Biologie, Serie Botanique (Romania)

Rev. Roum. Biol., Ser. Zool.
Revue Roumaine de Biologie, Serie Zoologie (Supersedes in Part Revue de Biologie, Academie de la Republique Populaire Roumaine) (Romania)

Rev. Roum. Chim.
Revue Roumaine de Chimie (Continuation of Revue de Chimie, Academie de la Republique Populaire Roumaine) (Romania)

Rev. Roum. Embryol. Cytol., Ser. Embryol.
Revue Roumaine d'Embryologie et de Cytologie, Serie d'Embryologie (Romania)

Rev. Roum. Inframicrobiol.
Revue Roumaine d'Inframicrobiologie (Romania)

Rev. Roum. Math. Pures Appl.
Revue Roumaine de Mathematiques Pures et Appliquees (Romania)

Rev. Roum. Med. Interne
Revue Roumaine de Medecine Interne (Romania)

Rev. Roum. Phys.
Revue Roumaine de Physique (Romania)

Rev. Roum. Physiol.
Revue Roumaine de Physiologie (Romania)

Rev. Roum. Sci. Tech., Ser. Electrotech. Energ.
Revue Roumaine des Sciences Techniques, Serie Electrotechnique et Energetique (Romania)

Rev. Roum. Sci. Tech., Ser. Mecan. Appl.
Revue Roumaine des Sciences Techniques, Serie de Mecanique Appliquee (Romania)

Rev. Roum. Sci. Tech., Ser. Met.
Revue Roymaine des Sciences Techniques, Serie de Metallurgie (Romania)

Rev. Sanid. Hig. Publica
Revista de Sanidad e Higiene Publica (Spain)

Rev. Sanit. Mil.
Revista Sanitara Militara (Romania)

Rev. Sci. Instrum.
Review of Scientific Instruments, The (U.S.)

Rev. Soc. Argent. Biol.
Revista de la Sociedad Argentina de Biologia (Argentina)

Rev. Soc. Cient. Paraguay
Revista de la Sociedad Cientifica del Paraguay (Paraguay)

Rev. Soc. Quim. Mex.
Revista de la Sociedad Quimica de Mexico (Mexico)

Rev. Soudure (Brussels)
Revue de la Soudure (Brussels) (Belgium)

Rev. Suisse Zool.
Revue Suisse de Zoologie (Switzerland)

Rev. Surg.
Review of Surgery (U.S.)

Rev. Univ. Nac. Tucuman, Ser. A
Revista de la Universidad Nacional de Tucuman, Serie A. Matematica y Fisica Teorica (Argentina)

Rev. Zooteh. Med. Vet.
Revista de Zootehnic si Medicina Veterinara (Romania)

Ric. Sci.
Ricerca Scientifica, La (Supersedes Ricerca Scientifica, La. Part 2 Rendiconti, Sezione A, A Biologica and Sezione B, Biologica) (Italy)

Rikagaku Kenkyusho Hokoku
Rikagaku Kenkyusho Hokoku (Reports of the Institute of Physical Chemical Research) (Japan)

R. I. Med. J.
Rhode Island Medical Journal, The (U.S.)

Rinsan Shikenjo Kenkyu Hokoku
Rinsan Shikenjo Kenkyu Hokoku (Report of Hokkaido Forest Products Research Institute) (Japan)

Rinsho Byori
Rinsho Byori (Japanese Journal of Clinical Pathology) (Japan)

Rinsho Hoshasen
Rinsho Hoshasen (Clinical Radiology) (Japan)

Rinsho To Kenkyu
Rinsho To Kenkyu (The Japanese Journal of Clinical and Experimental Medicine) (Japan)

XUM

Ritsumeikan Daigaku Rikogaku Kenkyusho Kiyo
Ritsumeikan Daigaku Rikogaku Kenkyusho Kiyo (Memoirs of the Research Institute of Science and Engineering, Ritsumeikan University) (Japan)

Riv. Aeronaut.
Rivista Aeronautica (Italy)

Riv. Anat. Patol. Oncol.
Rivista di Anatomia Patologica e di Oncologia (Italy)

Riv. Crit. Clin. Med.
Rivista Critica di Clinica Medica (Italy)

Riv. Ital. Saldatura
Rivista Italiana della Saldatura (Italy)

Riv. Med. Aeronaut. Spaz.
Rivista di Medicina Aeronautica e Spaziale (Italy)

Riv. Nuovo Cim.
Rivista del Nuovo Cimento (Italy)
Supersedes Supplemento al Nuovo Cimento

Riv. Ostet. Ginecol.
Rivista di Ostetricia e Ginecologia (Italy)

Riv. Radiol.
Rivista di Radiologia (Italy)

Rock Mech.
Rock Mechanics (Austria)
Supersedes Rock Mechanics and Engineering Geology

Rocky Mt. Med. J.
Rocky Mountain Medical Journal (U.S.)

Rocz. Chem.
Roczniki Chemii (Poland)

Rocz. Glebozn.
Roczniki Gleboznawcze (Poland)

Rocz. Panstw. Zakl. Hig.
Roczniki Panstwowego Zakladu Higieny (Poland)

Rocz. Pomor. Akad. Med. Szczecinie
Rocznik Pomorskiej Akademii Medycznej imienia Generala Karola Swierczewskiego w Szczecinie (Poland)

Roentgen Bl.
Roentgen Blaetter (West Germany)

Roentgenpraxis
Roentgenpraxis (West Germany)

Rom. Today
Romania Today (Romania)

Ropa Uhlie
Ropa a Uhlie (Czechoslovakia)

Roy. Soc. Health J.
Royal Society of Health Journal (England)

Rubber Chem. Technol.
Rubber Chemistry and Technology (U. S.)

Rudodobiv Met. (Sofia)
Rudodobiv i Metalurgiya (Sofia) (Bulgaria)

Rudy (Prague)
Rudy (Prague) (Czechoslovakia)

Rudy Metale Niezelaz.
Rudy i Metale Niezelazne (Poland)

RUM, Rev. Universelle Mines
RUM, Revue Universelle des Mines, de la Metallurgie, de la Mecanique, des Travaux Publics, des Sciences et des Arts Appliques a l'Industrie (Formerly Revue Universelle des Mines, de la Metallurgie, de la Mecanique, des Travaux Publics, des Sciences et des Arts Appliques a l'Industrie) (Belgium)

Russ. Chem. Rev. (Engl. Transl.)
Russian Chemical Reviews (English Translation of Uspekhi Khimii) (England)

Ryumachi
Ryumachi (The Official Journal of the Japan Rheumatism Association) (Japan)

S

Sabouraudia
Sabouraudia (England)

SAE (Soc. Automot. Eng.) J.
SAE (Society of Automotive Engineers) Journal (U.S.)

S. Afr. J. Agr. Sci.
South African Journal of Agricultural Science (South Africa)

S. Afr. J. Med. Sci.
South African Journal of Medical Sciences, The (South Africa)

S. Afr. J. Sci.
South African Journal of Science (South Africa)

S. Afr. Med. J.
South African Medical Journal (South Africa)

S. Afr. Mining Eng. J.
South African Mining and Engineering Journal (South Africa)

Saga Daigaku Nogaku Iho
Saga Daigaku Nogaku Iho (Agricultural Bulletin of the Saga University) (Japan)

Sahko
Sahko. Electricity in Finland (Finland)

Saishin Igaku
Saishin Igaku (Modern Medicine) (Japan)

Sakura X-Rei Shashin Kenkyu
Sakura X-Rei Shashin Kenkyu (The Sakura X-Ray Photographic Review) (Japan)

Samoletostr. Tekh. Vozdush. Flota
Samoletostroenie i Tekhnika Vozdushnogo Flota (U.S.S.R.)

Sanfujinka No Jissai
Sanfujinka No Jissai (Journal of Gynecological Practice) (Japan)

Sanfujinka No Sekai
Sanfujinka No Sekai (The World of Obstetrics and Gynecology) (Japan)

Sangyo Igaku
Sangyo Igaku (Japanese Journal of Industrial Health) (Japan

Sangyo Kikai
Sangyo Kikai (Industrial Machinery) (Japan)

Sangyo To Denki
Sangyo To Denki (Industry and Electricity) (Japan)

Sanshi Kenkyu
Sanshi Kenkyu (Sericultural Research) (Japan)

Sanyo Gijutsu Zasshi
Sanyo Gijutsu Zasshi (Journal of the San'yo Association for Advancement of Science and Technology) (Japan)

Sapporo Igaku Zasshi
Sapporo Igaku Zasshi (The Sapporo Medical Journal) (Japan)

Sb., Mosk. Inst. Stali Splavov
Sbornik, Moskovskii Institut Stali Splavov (U.S.S.R.)

Sb. Nauch. Tr. Gos. Nauch.-Issled. Inst. Tsvet. Metal.
Sbornik Nauchnykh Trudov Gosudarstvennogo Nauchno-Issledovatel'skogo Instituta Tsvetnykh Metallov (U.S.S.R.)

Sb. Nauch. Tr. Vses. Nauch.-Issled. Gorno-Met. Inst. Tsvet. Metal.
Sbornik Nauchnykh Trudov Vsesoyuznogo Nauchno-Issledovatel'skogo Gorno-Metallurgicheskogo Instituta Tsvetnykh Metallov (U.S.S.R.)

Sb. Rab. Vychisl. Tsent. Mosk. Gos. Univ.
Sbornik Rabot Vychislitel'nogo Tsentra Moskovskogo Gosudarstvennogo Universiteta (U.S.S.R.)

Sb. Tr. Agron. Fiz.
Sbornik Trudov po Agronomicheskoi Fizike (U.S.S.R.)

Sb. Tr. Inst. Metalloved. Fiz. Metal. Tsent. Nauch.-Issled. Inst. Chern. Met.
Sbornik Trudov Instituta Metallovedeniya i Fiziki Metallov Tsentral'nogo Nauchno-Issledovatel'skogo Instituta Chernoi Metallurgii (U.S.S.R.)

Sb. Tr., Mosk. Inzh.-Stroitel. Inst.
Sbornik Trudov, Moskovskii Inzherno-Stroitel'nyi Institut imeni V. V. Kuibysheva (U.S.S.R.)

Sb. Tr. Tsent. Nauch.-Issled. Inst. Chern. Met.
Sbornik Trudov Tsentral'nogo Nauchno-Issledovatel'skogo Instituta Chernoi Metallurgii (U.S.S.R.)

Sb. Tr., Ukr. Nauch.-Issled. Inst. Metal.
Sbornik Trudov, Ukrainskii Nauchno-Issledovatel'skii Institut Metallov (Ukrainian S.S.R.)

Sb. Tr., Vses. Nauch.-Issled. Proekt. Inst. Titana
Sbornik Trudov, Vsesoyuznyi Nauchno-Issledovatel'skii i Proektnyi Institut Titana (U.S.S.R.)

Sb. Tr. Vses. Zaoch. Politekh. Inst.
Sbornik Trudov Vsesoyuznogo Zaochnogo Politekhnicheskogo Instituta (U.S.S.R.)

Sb. Ved. Pr. Lek. Fak. Karlovy Univ. Hradci Kralove
Sbornik Vedeckych Praci Lekarske Fakulty Karlovy University v Hradci Kralove (Czechoslovakia)

Sb. Ved. Pr. Lek. Fak. Karlovy Univ. Hradci Kralove, Suppl.
Sbornik Vedeckych Praci Lekarske Fakulty Karlovy University v Hradci Kralove, Supplementum (Czechoslovakia)

Sb. Ved. Pr. VLVDU Hradci Kralove
Sbornik Vedeckych Praci VLVDU (Vojenskeho Lekarskeho Vyzkumneho a Doskolovaciho Ustavu) JEP v Hradci Kralove (Czechoslovakia)

Sb. Ved. Pr. Vys. Sk. Banske Ostrave, Rada Hutn.
Sbornik Vedeckych Praci Vysoke Skoly Banske v Ostrave, Rada Hutnicka (Czechoslovakia)

Scand. J. Clin. Lab. Invest.
Scandinavian Journal of Clinical and Laboratory Investigation (Norway)

Scand. J. Clin. Lab. Invest., Suppl.
Scandinavian Journal of Clinical and Laboratory Investigation, Supplement (Norway)

Scand. J. Gastroenterol.
Scandinavian Journal of Gastroenterology (Norway)

Scand. J. Haematol.
Scandinavian Journal of Haematology (Denmark)

Scand. J. Plast. Reconstr. Surg.
Scandinavian Journal of Plastic and Reconstructive Surgery (Sweden)

Scand. J. Urol. Nephrol.
Scandinavian Journal of Urology and Nephrology (Sweden)

Schmierstoffe Schmierungstech.
Schmierstoffe und Schmierungstechnik (East Germany)

Schriftenr. Bundesmin. Wiss. Forsch., Strahlenschutz (Munich)
Schriftenreihe des Bundesministers fuer Wissenschaftliche Forschung, Strahlenschutz (Munich) (West Germany)

Schweiz. Arch. Angew. Wiss. Tech.
Schweizer Archiv fuer Angewandte Wissenschaft und Technik (Switzerland)

Schweiz. Med. Wochensch.
Schweizerische Medizinische Wochenschrift (Switzerland)

Schweiz. Mineral. Petrogr. Mitt.
Schweizerische Mineralogische und Petrographische Mitteilungen (Switzerland)

Sci. Advan. Mater. Process Eng. Proc.
Science of Advanced Materials and Process Engineering Proceedings (U.S.)

Sci. Amer.
Scientific American (U.S.)

Sci. Avenir
Sciences et Avenir (France)

Sci. Ceram.
Science of Ceramics (England)

Sci. Cult. (Calcutta)
Science and Culture (Calcutta) (India)

Science
Science (U.S.)

Sciences (Paris)
Sciences et l'Enseignement des Sciences (Paris) (France)

Sci. Eng. Rep., Saitama Univ., Ser. C
Science and Engineering Reports of Saitama University, Series C, The (Japan)

Sci. Eng. Rev. Doshisha Univ.
Science and Engineering Review of the Doshisha University (Japan)

Scientia (Milan)
Scientia (Milan) (Italy)

Scientia (Valparaiso, Chile)
Scientia (Valparaiso, Chile) (Chile)

Sci. Forum
Science Forum (Canada)

Sci. Ind. (Karachi)
Science and Industry (Karachi) (Pakistan)

Sci. J.
Science Journal Incorporating Discovery (England)

Sci. Pap. Inst. Phys. Chem. Res. (Jap.)
Scientific Papers of the Institute of Physical and Chemical Research (Japan) (Formerly Journal of the Scientific) Research Institute (Japan)) (Japan)

Sci. Progr. (Oxford)
Science Progress (Oxford) (England)

Sci. Progr. Decouverte
Science Progres Decouverte (Formerly Science Progres - La Nature) (France)

Sci. Progr.-Nature
Science Progres-La Nature (France)
Changed to Science Progres Decouverte

Sci. Rep.
Science Reporter (U.S.)

Sci. Rep. Fac. Sci., Kyushu Univ., Geol.
Science Reports of the Faculty of Science, Kyushu University, Geology (Japan)

Sci. Rep. Hirosaki Univ.
Science Reports of the Hirosaki University (Japan)

Sci. Rep. Kanazawa Univ.
Science Reports of the Kanazawa University, The (Japan)

Sci. Rep. Kyoto Prefect. Univ. (Natur. Sci., Living Sci., Welfare Sci.)
Scientific Reports of the Kyoto Prefectural University (Natural Science, Living Science, and Welfare Science), The (Japan)

Sci. Rep. Res. Inst., Tohoku Univ., Ser. A
Science Reports of the Research Institutes, The, Tohoku University, Series A (Japan)

Sci. Rep. Saitama Univ., Ser. A
Science Reports of Saitama University, The, Series A (Japan)

Sci. Rep. Tohoku Univ., First Ser.
Science Reports of the Tohoku University, First Series (Japan)

Sci. Rep. Tohoku Univ., Fifth Ser.
Science Reports of the Tohoku University, Fifth Series (Japan)

Sci. Rep. Yokohama Nat. Univ., Sect. 1
Science Reports of the Yokohama National University, Section 1, Mathematics Physics, Chemistry (Japan)

Sci. Technol. (N.Y.)
Science and Technology (New York) (U.S.)

Sci. World
Scientific World (England)

Scot. Med. J.
Scottish Medical Journal (Scotland)

Scr. Met.
Scripta Metallurgica (U.S.)

Securitas
Securitas (Italy)

Secur. Med. Trav.
Securite et Medecine du Travail (France)

Seewart
Seewart (West Germany)

Seigyo Kogaku
Seigyo Kogaku (Journal of the Japan Association of Automatic Control Engineers) (Japan)

Seikagaku
Seikagaku (Japan)

XUM

Seikei Geka
Seikei Geka (Orthopedic Surgery) (Japan)

Seiken Ziho
Seiken Ziho (Reports of the Kihara Inst. for Biological Research) (Japan)

Seisan Kenkyu
Seisan Kenkyu (Monthly Journal of the Institute of Industrial Science, University of Tokyo) (Japan)

Seitetsu Kenkyu
Seitetsu Kenkyu (Yawata Technical Report) (Japan)

Sekiyu Gakkaishi
Sekiyu Gakkaishi (Journal of the Japan Petroleum Institute) (Japan)

Sekiyu To Sekiyu Kagaku
Sekiyu To Sekiyu Kagaku (Petroleum and Petrochemicals) (Japan)

Sel'skokhoz. Biol.
Sel'skokhozyaistvennaya Biologiya (Formerly Agrobiologiya) (U.S.S.R.)

Sementi Elette
Sementi Elette (Italy)

Semento Konkurito
Semento Konkurito (Cement and Concrete) (Japan)

Sem. Hop. Paris
Semaine des Hopitaux de Paris, La (France)

Seminars Hematol.
Seminars in Hematology (U.S.)

Sendai Astron. Rap.
Sendai Astronomiaj Raportoj (Japan)

Sen'i
Sen'i (Textile Fibers) (Japan)

Sen'i Gakkaishi
Sen'i Gakkaishi (Journal of the Society of Fiber Science and Technology, Japan) (Japan)

Senpaku Gijutsu Kenkyujo Hokoku
Senpaku Gijutsu Kenkyujo Hokoku (Report of Ship Research Institute) (Japan)

Senten Ijo
Senten Ijo (Congenital Anomalies) (Japan)

Separ. Sci.
Separation Science (U.S.)

Settim. Med.
Settimana Medica (Italy)

Shan Tung I K'an
Shan Tung I K'an (Shantung Medical Journal) (China)

Shibaura Kogyo Daigaku Kenkyu Hokoku
Shibaura Kogyo Daigaku Kenkyu Hokoku (Research Reports of Shibaura Institute of Technology) (Japan)

Shika Gakuho
Shika Gakuho (The Journal of the Tokyo Dental College Society) (Japan)

Shikizai Kyokaishi
Shikizai Kyokaishi (Color Materials) (Japan)

Shimazu Hyoron
Shimazu Hyoron (Shimazu Review) (Japan)

Shindan To Chiryo
Shindan To Chiryo (Diagnosis and Treatment) (Japan)

Shinkei Kenkyu No Shimpo
Shinkei Kenkyu No Shimpo (Advances in Neurological Sciences) (Japan)

Shin Kinzoku
Shin Kinzoku (New Metals and Technics) (Japan)

Shin Kinzoku Kogyo
Shin Kinzoku Kogyo (Newer Metal Industry) (Japan)

Shinku
Shinku (Journal of the Vacuum Society of Japan) (Japan)

Shinshu Igaku Zasshi
Shinshu Igaku Zasshi (The Shinshu Medical Journal) (Japan)

Shinyaku To Rinsho
Shinyaku To Rinsho (Journal of New Remedies and Clinic) (Japan)

Shipbuild. Shipping Rec.
Shipbuilding and Shipping Record (England)

Shipping World Shipbuilder
Shipping World and Shipbuilder (England)

Shiritsu Sapporo Byoin Ishi
Shiritsu Sapporo Byoin Ishi (The Journal of Sapporo Municipal General Hospital (Acta Medica Nosocomi Sapporo)) (Japan)

Shitsuryo Bunseki
Shitsuryo Bunseki (Mass Spectroscopy) (Japan)

Shokubai, Suppl.
Shokubai, Suppl. (Catlyst, Suppl.) (Japan)

Shokuhin Eiseigaku Zasshi
Shokuhin Eiseigaku Zasshi (Journal of the Food Hygienic Society of Japan) (Japan)

Shokuryo Kenkyujo Kenkyu Hokoku
Shokuryo Kenkyujo Kenkyu Hokoku, (Report of the Food Research Institute) (Japan)

Showa Densen Denran Rebyu
Showa Densen Denran Rebyu (Showa Wire and Cable Review) (Japan)

Shujutsu
Shujutsu (Operation) (Japan)

SIAM (Soc. Ind. Appl. Math.) J. Appl. Math.
SIAM (Society For Industrial and Applied Mathematics) Journal on Applied Mathematics (Formerly Journal of the Society for Industrial and Applied Mathematics) (U.S.)

SIAM (Soc. Ind. Appl. Math.) Rev.
SIAM (Society for Industrial and Applied Mathematics) Review (U.S.)

Sicher Sicher
Sicher ist Sicher (West Germany)

Siemens Rev.
Siemens Review (West Germany)

Sight-Sav. Rev.
Sight-Saving Review, The (U. S.)

Silikaty
Silikaty (Czechoslovakia)

Simulation
Simulation (U.S.)

Skoda Rev.
Skoda Review (Czechoslovakia)

Sky Telesc.
Sky and Telescope (U.S.)

S. Med. J.
Southern Medical Journal (U.S.)

Soc. Astron. Ital., Mem.
Societa Astronomica Italiana, Memorie (Italy)

Soc. Chem. Ind. (London), Monogr.
Society of Chemical Industry (London), Monograph (England)

Soc. Petrol. Eng. J.
Society of Petroleum Engineers Journal, The (U.S.)

Soc. Sci. Fenn., Comment. Phys.-Math.
Societas Scientiarum Fennica, Commentationes Physico-Mathematicae (Finland)

Soda To Enso
Soda To Enso (Soda and Chlorine) (Japan)

Soil Biol. Biochem.
Soil Biology and Biochemistry (England)

Soil Sci.
Soil Science (U.S.)

Soil Sci. Plant Nutr. (Tokyo)
Soil Science and Plant Nutrition (Tokyo) (Japan)

Soil Sci. Soc. Amer., Proc.
Soil Science Society of America, Proceedings (U.S.)

Solar Phys.
Solar Physics. (Netherlands)

Solar Syst. Res. (USSR) (Engl. Transl.)
Solar Systems Research (USSR) (English Translation of Astronomicheskii Vestnik) (U.S.)

Solid State Commun.
Solid State Communications (England-U.S.)

Solid-State Electron.
Solid-State Electronics. An International Journal (England)

Solid State Technol.
Solid State Technology (U.S.)

Soobshch. Akad. Nauk Gruz. SSR
Soobshcheniya Akademii Nauk Gruzinskoi SSR (Georgian S.S.R.)

Soryushiron Kenkyu
Soryushiron Kenkyu (Study of Elementary Particles) (Japan)

Southeast. Geol.
Southeastern Geology (U.S.)

Sov. Antarct. Exped. Inform. Bull. (Engl. Transl.)
Soviet Antarctic Expedition Information Bulletin (English Translation of Informatsionnyi Byulleten Sovetskoi Antarkticheskoi Ekspeditsii) (U.S.)

Sov. Astron. AJ (Engl. Transl.)
Soviet Astronomy-AJ (English Translation of Astronomicheskii Zhurnal) (U.S.)

Sov. Geol.
Sovetskaya Geologiya (U.S.S.R.)

Sov. Krasnyi Krest
Sovet i Krasnyi Krest (U.S.S.R.)

Sov. Med.
Sovetskaya Meditsina (U.S.S.R.)

Sov. Phys. -Acoust. (Engl. Transl.)
Soviet Physics-Acoustics (English Translation of Akusticheskii Zhurnal) (U.S.)

Sov. Phys.-Cryst. (Engl. Transl.)
Soviet Physics-Crystallography (English Translation of Kristallografiya) (U.S.)

Sov. Phys.-Solid State (Engl. Transl.)
Soviet Physics-Solid State (English Translation of Fizika Tverdogo Tela) (U.S.)

Sov. Phys.-Tech. Phys. (Engl. Transl.)
Soviet Physics-Technical Physics (English Translation of Zhurnal Tekhnicheskoi Fiziki) (U.S.)

Space/Aeronaut.
Space/Aeronautics (U.S.)

Space Biol. Med. (USSR) (Engl. Transl.)
Space Biology And Medicine (USSR) (English Translation of Kosmicheskaya Biologiya i Meditsina) (U.S.)

Space Life Sci.
Space Life Sciences (Netherlands)

Space Sci. Rev.
Space Science Reviews (Netherlands)

Spec. Contrib. Geophys. Inst., Kyoto Univ.
Special Contributions of the Geophysical Institute, Kyoto University (Japan)

Spectrochim. Acta
Spectrochimica Acta (England)
Superseded by Spectrochimica Acta, Part A and Part B

Spectrochim. Acta, Part A
Spectrochimica Acta, Part A. Molecular Spectroscopy (England)

Spectrochim. Acta, Part B
Spectrochimica Acta, Part B. Atomic Spectroscopy (England)

Spectrosc. Lett.
Spectroscopy Letters (U.S.)

Sperimentale
Sperimentale, Lo Archivio di Biologia Normale e Patologica (Italy)

Srp. Arh. Celok. Lek.
Srpski Arhiv za Celokupno Lekarstvo (Yugoslavia)

Staerke
Staerke, Die (West Germany)

Stahl Eisen
Stahl und Eisen (West Germany)

Stain Technol.
Stain Technology A Journal for Microtechnic and Histochemistry (U.S.)

Stal
Stal (U.S.S.R.)

Staub
Staub (West Germany)

Steel
Steel (U.S.)

Steklo Keram.
Steklo i Keramika (U.S.S.R.)
Issued in English Translation as Glass and Ceramics (USSR)

Sterne Weltraum
Sterne und Weltraum (West Germany)

Steroids
Steroids. An International Journal (U.S.)

Stiinta Solului
Stiinta Solului (Romania)

Stomatologie (Athens)
Stomatologia (Athens) (Greece)

Stomatologica (Genoa)
Stomatologica (Genoa) (Italy)

Stomatologiya
Stomatologiya (U.S.S.R.)

Strahlenschutz Forsch. Prax.
Strahlenschutz in Forschung und Praxis (West Germany)

Strahlentherapie
Strahlentherapie (West Germany)

Strojirenstvi
Strojirenstvi (Czechoslovakia)

Strojnicky Cas.
Strojnicky Casopis (Czechoslovakia)

Stud. Appl. Math.
Studies in Applied Mathematics (Formerly Journal of Mathematics and Physics (Cambridge, Mass.)) (U.S.)

Stud. Biophys.
Studia Biophysica (East Germany)

Stud. Cercet. Astron.
Studii si Cercetari de Astronomie (Romania)

Stud. Cercet. Biochim.
Studii si Cercetari de Biochimie (Formerly Academia Republicii Populare Romine, Institutul de Biochemie, Studii si Cercetari de Biochimie) (Romania)

Stud. Cercet. Biol., Ser. Bot.
Studii bi Cercetari de Biologie, Seria Botanica (Romania)

Stud. Cercet. Biol., Ser. Zool.
Studii si Cercetari de Biologie, Seria Zoologie (Romania)

Stud. Cercet. Chim.
Studii si Cercetari de Chimie (Romania)

Stud. Cercet. Embriol. Citol., Ser. Embriol.
Studii si Cercetari de Embriologie si Citologie, Seria Embriologie (Romania)

Stud. Cercet. Endocrinol.
Studii si Cercetari de Endocrinologie (Romania)

Stud. Cercet. Energ. Electroteh.
Studii si Cercetari de Energetica si Electrotehnica (Romania)

Stud. Cercet. Fiz.
Studii si Cercetari de Fizica (Formerly Academia Republicii Populare Romine, Institutul de Fizica Atomica si Institutul de Fizica, Studii si Cercetari de Fizica) (Romania)

Stud. Cercet. Fiziol.
Studii si Cercetari de Fiziologie (Formerly Academie Republicii Populare Romine, Institutul de Fiziologie Normala si Pathologie Dr. D. Danielo-Polu, (Studii si Cercetari de Fiziologie) (Romania)

XUM

Stud. Cercet. Geol., Geofiz., Geogr., Ser. Geofiz.
Studii si Cercetari de Geologie, Geofizica, Geografie, Seria Geofizica (Romania)

Stud. Cercet. Inframicrobiol.
Studii si Cercetari de Inframicrobiologie (Romania)

Stud. Cercet. Mat.
Studii si Cercetari Matematice (Romania)

Stud. Cercet. Med. Intern.
Studii si Cercetari de Medicina Interna (Romania)

Stud. Conserv.
Studies in Conservation (England)

Stud. Gen.
Studium Generale (West Germany)

Stud. Geophys. Geod.
Studia Geophysica et Geodaetica, Ceskoslovenska Akademie Ved (Czechoslovakia)

Stud. Radiat. Eff. Solids
Studies in Radiation Effects on Solids (U. S.)

Stud. Univ. Babes-Bolyai, Ser. Chem.
Studia Universitatis Babes-Bolyai, Series Chemia (Romania)

Stud. Univ. Babes-Bolyai, Ser. Math.-Phys.
Studia Universitatis Babes-Bolyai, Series Mathematica-Physica (Romania)

Stud. Univ. Babes-Bolyai, Ser. Phys.
Studia Universitatis Babes-Bolyai, Series Physica (Romania)
Continues in part Studia Universitatis Babes-Bolyai, Series Mathematica-Physica

Suiyokaishi
Suiyokaishi (Transactions of the Mining and Metallurgical Alumni Association) (Japan)

Sulzer Tech. Rev.
Sulzer Technical Review (Switzerland)

Sumitomo Elec. Rev.
Sumitomo Electric Review, The (Sumitomo Denki) (Japan)

Sumitomo Elec. Tech. Rev.
Sumitomo Electric Technical Review (Japan)

Sumitomo Kikai Giho
SumitoMo Kikai Giho (Sumitomo Machinery) (Japan)

Sumitomo Kinzoku
Sumitomo Kinzoku (Sumitomo Metals) (Japan)

Sunshine State Agr. Res. Rep.
Sunshine State Agricultural Research Report (U.S.)

Suomen Kem.
Suomen Kemistilehti (Finland)

Surface Sci.
Surface Science (Netherlands)

Surg. Clin. N. Amer.
Surgical Clinics of North America, The (U.S.)

Surg. Forum
Surgical Forum, Proceedings of the Forum Sessions, Clinical Congress of the American College of Surgeons (U.S.)

Surg. Gynecol. Obstet.
Surgery, Gynecology and Obstetrics with International Abstracts of Surgery (U.S.)

Surv. Ophthamol.
Survey of Ophthamology (U.S.)

Surv. Progr. Chem.
Survey of Progress in Chemistry (U. S.)

Suvrem. Med.
Suvremenna Meditsina (Bulgaria)

Svar. Proizv.
Svarochnoe Proizvodstvo (U.S.S.R.)
Issued in English Translation as Welding Production (USSR)

Svetotekhnika
Svetotekhnika (U.S.S.R.)

Symp. Genet. Biol. Ital.
Symposia Genetica et Biologica Italica (Italy)

Symp. Zool. Soc. London
Symposia of the Zoological Society of London and The Malacological Society of London (England)

Szkło Ceram.
Szkło i Ceramika (Poland)

T

Taiki Hoshano Kansoku Seiseki
Taiki Hoshano Kansoku Seiseki (Bulletin of the Atmospheric Radioactivity) (Japan)

Taisha
Taisha (Metabolism and Disease) (Japan)

T'ai-wan I Hsueh Hui Tsa Chih
T'ai-wan I Hsueh Hui Tsa Chih (Journal of the Formosan Medical Association) (China (Taiwan))

Takeda Kenkyusho Nempo
Takeda Kenkyusho Nempo (Annual Reports of the Takeda Research Laboratories (Japan)

Talanta
Talanta (England)

Tandlaegebladet
Tandlaegebladet (Denmark)

Tanso
Tanso (Carbons) (Japan)

Tech. Eau (Brussels)
Technique de l'Eau et de Assainissement (Brussels) (Belgium)

Tech. Mitt. AEG-Telefunken
Technische Mitteilungen AEG-Telefunken (A Continuation of AEG-Mitteilungen) (West Germany)

Tech. Mitt. Krupp, Forschungsber.
Technische Mitteilungen Krupp, Forschungsberichte (West Germany)

Tech. Mitt. Krupp, Werksber.
Technische Mitteilunge Krupp, Werksberichte (West Germany)

Tech. Mod.
Technique Moderne, La (France)

Technica (Basel)
Technica (Basel) (Switzerland)

Technik (Berlin)
Technik (Berlin), Die (East Germany)

Technology (Sindri)
Technology (Sindri). Quarterly Bulletin of the Planning and Development Div., Fertilizer Corp. of India Ltd. (India)

Technol. Rep. Osaka Univ.
Technology Reports of the Osaka University (Japan)

Technol. Rep. Tohoku Univ.
Technology Reports of the Tohoku University (Japan)

Technol. Rev.
Technology Review (U.S.)

Tech. Rep. Eng. Res. Inst., Kyoto Univ.
Technical Reports of the Engineering Research Institute, Kyoto University (Japan)

Tech. Rep. ISSP (Inst. Solid State Phys.), Ser. A
Technical Report of ISSP (Inst. for Solid State Physics), Series A (Japan)

Tech. Sci. Munic.
Techniques et Sciences Municipales (France)

Tech. Ueberwach.
Technische Ueberwachung (West Germany)

Tec. Ital.
Tecnica Italiana (Italy)

Tehnika (Belgrade)
Tehnika (Belgrade) (Yugoslavia)

Teishin Igaku
Teishin Igaku (Medical Journal for Communication) (Japan)

Tekh. Misul
Tekhnicheska Misul (Bulgaria)

Teknol. Organ. Proizvod.
Tekhnologiya i Organizatsiya Proizvodstva (Ukrainian S.S.R.)

Tek. Tidskr.
Teknisk Tidskrift (Sweden)

Tek. Ukebl.
Teknisk Ukeblad (Norway)

Tek. Vetensk. Forsk.
Teknisk Vetenskaplig Forskning (Sweden)

Telecommun. J.
Telecommunication Journal (Switzerland)

Tellus
Tellus. A Quarterly Journal of Geophysics (Sweden)

Tensor
Tensor (Japan)

Teor. Eksp. Khim.
Teoreticheskaya i Eksperimental'naya Khimiya (Ukrainian S.S.R.)
Issued in English Translation as Theoretical and Experimental Chemistry (USSR)

Teor. Mat. Fiz.
Teoreticheskaya i Matematicheskaya Fizika (U.S.S.R.)

Teploenergetika
Teploenergetika (U.S.S.R.)
Issued in English Translations as Thermal Engineering

Teplofiz. Vys. Temp.
Teplofizika Vysokikh Temperatur (U.S.S.R.)
Issued in English Translation as High Temperature (USSR)

Teratology
Teratology (U.S.)

Termotecnica (Milan)
Termotecnica, La (Milan) (Italy)

Tetrahedron
Tetrahedron. An International Journal of Organic Chemistry (England)

Tetrahedron Lett.
Tetrahedron Letters (England)

Tetsu To Hagane
Tetsu To Hagane (Journal of the Iron and Steel Institute) (Japan)

Tex. J. Sci.
Texas Journal of Science, The (U.S.)

Tex. Med.
Texas Medicine (U.S.)

Tex. Rep. Biol. Med.
Texas Reports on Biology and Medicine (U.S.)

Text. Res. J.
Textile Research Journal (U.S.)

Theor. Appl. Genet.
Theoretical and Applied Genetics (Formerly Zuechter. Genetics and Breeding Research) (West Germany)

Therapie
Therapie (France)

Therapiewoche
Therapiewoche, Die (West Germany)

Ther. Umsch.
Therapeutische Umschau (Switzerland)

Theses Catholic Med. Coll. (Seoul)
Theses of Catholic Medical College (Seoul) (South Korea)

Thin Solid Films
Thin Solid Films (Netherlands)

Thorax
Thorax (England)

Tic (Albany, N. Y.)
Tic (Albany, New York) (U.S.)

Tidsskr. Kjemi, Bergv. Met.
Tidsskrift for Kjemi, Bergvesen og Metallurgi (Norway)
Changed to Kjemi

Tidsskr. Norske Laegforen.
Tidsskrift for den Norske Laegeforening (Norway)

Tijdschr. Diergeneesk.
Tijdschrift voor Diergeneeskunde (Netherlands)

Tijdschr. Soc. Geneesk.
Tijdschrift voor Sociale Geneeskunde (Netherlands)

Tin Uses
Tin and Its Uses (England)

Tohoku Daigaku Hisuiyoeki Kagaku Kenkyusho Hokoku
Tohoku Daigaku Hisuiyoeki Kagaku Kenkyusho Hokoku (Bulletin of the Chemical Research Inst. of Non-Aqueous Solutions, Tohoku University) (Japan)

Tohoku Daigaku Kagaku Keisoku Kenkyusho Hokoku
Tohoku Daigaku Kagaku Keisoku Kenkyusho Hokoku (Bulletin of the Research Institute for Scientific Measurements, Tohoku University) (Japan)

Tohoku Igaku Zasshi
Tohoku Igaku Zasshi (Tohoku Medical Journal) (Japan)

Tohoku J. Exp. Med.
Tohoku Journal of Experimental Medicine, the (Japan)

Tokai Daigaku Kiyo Kogakubu
Tokai Daigaku Kiyo Kogakubu (Proceedings of the Faculty of Engineering, of Tokai University (Japan)

Tokushima Daigaku Gakugei Kiyo, Shizenkagaku
Tokushima Daigaku Gakugei Kiyo, Shizenkagaku (Journal of Gakugei, Tokushima University, Natural Science) (Japan)

Tokushima Daigaku Yakugaku Kenkyu Nempo
Tokushima Daigaku Yakugaku Kenkyu Nempo (Annual Reports of the Faculty of Pharmacy, Tokushima University) (Japan)

Tokushima J. Exp. Med.
Tokushima Journal of Experimental Medicine, The (Japan)

Tokyo Daigaku Kogakubu Kiyo, A
Tokyo Daigaku Kogakubu Kiyo, A (Journal of the Faculty of Engineering, University of Tokyo, Series A) (Japan)

Tokyo Daigaku Uchu Koku Kenkyusho Hokoku
Tokyo Daigaku Uchu Koku Kenkyusho Hokoku (Bulletin of the Institute of Space and Aeronautical Science, University of Tokyo) (Japan)

Tokyo Ika Daigaku Zasshi
Tokyo Ika Daigaku Zasshi (The Journal of Tokyo Medical College) (Japan)

Tokyo Jikeikai Ika Daigaku Zasshi
Tokyo Jikeikai Ika Daigaku Zasshi (Tokyo Jikeikai Medical Journal) (Japan)

Tokyo Joshi Ika Daigaku Zasshi
Tokyo Joshi Ika Daigaku Zasshi (Journal of Tokyo Women's Medical College) (Japan)

Tokyo Kogyo Daigaku Gakuho
Tokyo Kogyo Daigaku Gakuho (Bulletin of the Tokyo Institute of Technology) (Japan)

Tokyo Kogyo Shikensho Hokoku
Tokyo Kogyo Shikensho Hokoku (Reports of the Government Chemical Industrial Research Institute, Tokyo) (Japan)

Tool Mfg. Eng.
Tool and Manufacturing Engineer, The (U.S.)
Superseded by Manufacturing Engineering and Management

Toshiba Rebyu
Toshiba Rebyu (Toshiba Review) (Japan)

Toshiba Rev., Int. Ed.
Toshiba Review, International Edition (Japan)

Toso Gijutsu
Toso Gijutsu (Painting Technology) (Japan)

Toxicol. Appl. Pharmacol.
Toxicology and Applied Pharmacology (U.S.)

Toxicon
Toxicon (U. S.-England)

XUM

Trans. Amer. Acad. Ophthalmol. Oto-Laryngol.
Transactions of the American Academy of Ophthalmology and Oto-Laryngology (U.S.)

Trans. Amer. Crystallogr. Ass.
Transactions of the American Crystallographic Association (U. S.)

Trans. Amer. Fish. Soc.
Transactions of the American Fisheries Society (U.S.)

Trans. Amer. Geophys. Union
Transactions of the American Geophysical Union (U.S.)

Trans. Amer. Neurol. Ass.
Transactions of the American Neurological Association (U.S.)

Trans. Amer. Nucl. Soc.
Transactions of the American Nuclear Society (U.S.)

Trans. Amer. Ophthalmol. Soc.
Transactions of the American Ophthalmological Society (Canada)

Trans. Amer. Soc. Artif. Intern. Organs
Transactions, American Society for Artificial Internal Organs (U.S.)

Trans. Bose Res. Inst. (Calcutta)
Transactions of the Bose Research Institute (Calcutta) (India)

Trans. Brit. Ceram. Soc.
Transactions of the British Ceramic Society Incorporating British Ceramic Abstracts (England)

Trans. Can. Inst. Mining Met.
Transactions of the Canadian Institute of Mining and Metallurgy and of the Mining Society of Nova Scotia (Canada)

Trans. Faraday Soc.
Transactions of the Faraday Society (England)

Trans. Indian Ceram. Soc.
Tranactions of the Indian Ceramic Society (India)

Trans. Indian Inst. Metals
Transactions of the Indian Instiute of Metals (India)

Trans. Inst. Chem. Eng. (London)
Transactions of the Institution of Chemical Engineers (London) (England)
Included in Chemical Engineer, The (London)

Trans. Inst. Electron. Commun. Eng. Jap., Part B
Transactions of the Institute of Electronics and Communication Engineers of Japan, The, Part B (Japan)

Trans. Inst. Metal Finish.
Transactions of the Institute of Metal Finishing (England)

Trans. Iron Steel Inst. Jap.
Transactions of the Iron and Steel Institute of Japan (Japan)

Trans. Jap. Inst. Metals
Transactions of the Japan Institute of Metals (Sendai) (Japan)

Trans. Jap. Inst. Metals, Suppl.
Transactions of the Japan Institute of Metals, Supplesant (Japan)

Trans. Jap. Soc. Aeronaut. Space Sci.
Transactions of the Japan Society for Aeronautics and Space Sciences (Japan)

Trans. Met. Soc. AIME
Transactions of the Metallurgical Society of AIME (American Institute of Mining, Metallurgical, and Petroleum Engineers) (U.S.)
Superseded by Metallurgical Transactions

Trans. Nat. Res. Inst. Metals (Tokyo)
Transactions of the National Research Institute for Metals (Tokyo) (Japan)

Trans. N. Y. Acad. Sci.
Transactions of the New York Academy of Sciences (U.S.)

Trans. Pac. Coast Obstet. Gynecol. Soc.
Transactions of the Pacific Coast Obstetrical and Gynecological Society (U.S.)

Trans. Pac. Coast Oto-Ophthalmol. Soc.
Transactions of the Pacific Coast Oto-Ophthalmological Society (U.S.)

Transplantation
Transplantation (Formerly Transplantation Bulletin) (U.S.)

Transplant. Proc.
Transplantation Proceedings (U.S.)

Trans. Roy. Soc. Can.
Transactions of the Royal Society of Canada (Canada)

Trans. Soc. Instrum. Contr. Eng.
Transactions of the Society of Instrument and Control Engineers (Japan)

Trans. Soc. Occup. Med.
Transactions of the Society of Occupational Medicine (England)

Tr. Astrofiz. Inst., Akad. Nauk Kaz. SSR
Trudy Astrofizicheskogo Instituta, Akademiya Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Trav. Secur.
Travail et Securite (France)

Trend Eng.
Trend in Engineering (U.S.)

Tr. Fiz. Inst., Akad. Nauk SSSR
Trudy Fizicheskogo Instituta Imeni P. N. Lebedeva, Akademiya Nauk SSSR (U.S.S.R.)
Issued in English Translation as Proceedings (Trudy) of the P. N. Lebedev Physics Institute

Tr. Frunz. Politekh. Inst.
Trudy Frunzenskogo Politekhnicheskogo Instituta (Kirghiz S.S.R.)

Tr., Gos. Nauch.-Issled. Proekt. Inst. Splavov Obrab. Tsvet. Metal.
Trudy, Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Institut Splavov i Obrabotki Tsvetnykh Metallov (U.S.S.R.)

Tr. Gruz. Politekh. Inst.
Trudy Gruzinskogo Politekhnicheskogo Instituta (Georgian S.S.R.)

Tr. Inst. Bot., Akad. Nauk Kaz. SSR
Trudy Instituta Botaniki, Akademiya Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Tr. Inst. Ekol. Rast. Zhivotn.
Trudy Instituta Ekologii Rastenii i Zhivotnykh (U.S.S.R.)

Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural. Filial
Trudy Instituta Elektrokhimii, Akademiya Nauk SSSR, Ural'skii Filial (U.S.S.R.)

Tr. Inst. Fiz. Astron., Akad. Nauk Est. SSR
Trudy Instituta Fiziki i Astronomii, Akademiya Nauk Estonskoi SSR (Estonian S.S.R.)

Tr. Inst. Fiziol., Akad. Nauk Gruz. SSR
Trudy Instituta Fiziologii, Akademiya Nauk Gruzinskoi SSR (Georgian S.S.R.)

Tr. Inst. Khim. Nauk, Akad. Nauk Kaz. SSR
Trudy Instituta Khimicheskikh Nauk, Akademiya Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Tr. Inst. Met. Obogashch., Akad. Nauk Kaz. SSR
Trudy Instituta Metallurgii i Obogashcheniya, Akademiya Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Tr. Irkutsk. Politekh. Inst.
Trudy Irkutskogo Politekhnicheskogo Instituta (U.S.S.R.)

Tr. Kaz. Aviats. Inst., Ser. Khim.
Trudy Kazanskogo Aviatsionnogo Instituta, Seriya Khimicheskaya (U.S.S.R.)

Tr. Kaz. Nauch.-Issled. Inst. Onkol. Radiol.
Trudy Kazakhskogo Nauchno-Issledovatel'skogo Instituta Onkologii i Radiologii (Kazakh S.S.R.)

Tr. Khim.-Met. Inst., Akad. Nauk Kaz. SSR
Trudy Khimiko-Metallurgicheskogo Instituta, Akademiya Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Tr. Kom. Anal. Khim. Akad. Nauk SSSR, Inst. Geokhim. Anal. Khim.
Trudy Komissi po Analiticheskoi Khimii Akademiya Nauk SSSR, Institut Geokhimii i Analiticheskoi Khimii imeni V. I. Vernadskogo (U.S.S.R.)

Tr. Leningrad. Politekh. Inst.
Trudy Leningradskogo Politekhnicheskogo Instituta imeni M. I. Kalinina (U.S.S.R.

Tr. Metrol. Inst. SSSR
Trudy Metrologicheskikh Institutov SSSR (U.S.S.R.)

Tr., Mosk. Aviats. Tekhnol. Inst.
Trudy, Moskovskii Aviatsionnyi Tekhnologicheskii Institut (U.S.S.R.)

Tr. Mosk. Khim.-Tekhnol. Inst.
Trudy Moskovskogo Khimiko-Tekhnologicheskogo Instituta imeni D. I. Mendeleeva (U.S.S.R.)

Tr. Mosk. Obshchest. Ispyt. Prir., Otd. Biol.
Trudy Moskovskogo Obshchestva Ispytatelei Prirody, Otdel Biologicheskii (U.S.S.R.)

Tr. Mosk. Vet. Akad.
Trudy Moskovskoi Veterinarnoi Akademii (U.S.S.R.)

Tr. Nauch.-Issled. Inst. Geol. Arktiki
Trudy Nauchno-Issledovatel'skogo Instituta Geologii Arkitiki (U.S.S.R.)

Tr. Soyuznogo Nauch.-Issled. Inst. Priborostr.
Trudy Soyuznogo Nauchno-Issledovatel'skogo Instituta Priborostroeniya (U.S.S.R.)

Tr. Tallin. Politekh. Inst., Ser. A
Trudy Tallinskogo Politekhnicheskogo Instituta, Seriya A (Estonian S.S.R.)

Tr. Tashkent. Gos. Univ.
Trudy Tashkentskogo Gosudarstvennogo Universiteta im. V. I. Lenina (U.S.S.R.)

Tr. Tomsk. Radioelektron. Elektron. Tekh.
Trudy Tomskogo Instituta Radioelektroniki i Elektronnoi Tekhniki (U.S.S.R.)

Tr., Tsent Nauch.-issled. Gornorazved. Inst.
Trudy. Tsentral'nyi Nauchno-Issledovatel'skii Gornorazvedochnyi Institut (U.S.S.R.)

Tr. Univ. Druzhby Narodov
Trudy Universiteta Druzhby Narodov (U.S.S.R.)

Tr., Ural. Nauch.-Issled. Proekt. Inst. Mednoi Prom.
Trudy, Ural'skii Nauchno-Issledovatel'skii i Proektnyi Institut Mednoi Promyshlennosti (U.S.S.R.)

Tr. Ural. Politekh. Inst.
Trudy Ural'skogo Politekhnicheskogo Instituta imeni S. M. Kirova (U.S.S.R.)

Tr. Vost. Inst. Ogneuporov
Trudy Vostochnogo Instituta Ogneuporov (U.S.S.R.)

Tr. Vses. Inst. Eksp. Vet.
Trudy Vsesoyuznogo Instituta Eksperimental'noi Veterinarii (U.S.S.R.)

Tr. Vses. Nauch.-Issled. Geol. Inst.
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Geologicheskogo Instituta (U.S.S.R.)

Tr. Vses. Nauch.-Issled. Inst. Khim. Reaktivov
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Khimicheskikh Reaktivov (U.S.S.R.)

Tr., Vses. Nauch.-Issled. Inst. Pererab. Nefti
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut po Pererabotke Nefti (U.S.S.R.)

Tr. Vses. Nauch.-Issled. Inst. Radiats. Tekh.
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Radiatsionnoi Tekhniki (U.S.S.R.)

Tr. Vses. Nauch.-Issled. Inst. Stand. Obraztsov Spektr. Etalonov
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Standartnykh Obraztsov i Spektral'nykh Etalonov (U.S.S.R.)

Tr., Vses. Nauch.-Issled. Inst. Yadern. Geofiz. Geokhim.
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Yadernoi Geofiziki i Geokhimii (U.S.S.R.)

TRW Space Log
TRW Space Log (U.S.)

Tschermaks Mineral. Petrogr. Mitt.
Tschermaks Mineralogische und Petrographische Mitteilungen (Austria)

Tsitol. Genet.
Tsitologiya i Genetika (Ukrainian S.S.R.)

Tsitologiya
Tsitologiya (U.S.S.R.)

Tsvetn. Metal.
Tsvetnye Metally (U.S.S.R.)
For English Translation see the Soviet Journal of Non-Ferrous Metals

Tumori
Tumori (Italy)

Tungsten News
Tungsten News (U.S.)

Turrialba
Turrialba (Costa Rica)

U

Uchusen Kenkyu
Uchusen Kenkyu (Studies of Cosmic Ray) (Japan)

Uch. Zap. Azerb. Gos. Univ., Ser. Fiz.-Mat. Nauk
Uchenye Zapiski Azerbaidzhanskogo Gosudarstvennogo Universiteta, Seriya Fiziko-Matematicheskikh Nauk (Azerbaidzhan S.S.R.)

Uch. Zap. Azerb. Gos. Univ., Ser. Khim. Nauk
Uchenye Zapiski Azerbaidzhanskogo Gosudarstvennogo Universiteta im. S. M. Kirova, Seriya Khimicheskikh Nauk (Azerbaidzhan S.S.R.)

Uch. Zap. Gos. Pedagog. Inst.
Uchenye Zapiski Gosurdastyennogo Pedagogicheskogo Instituta imeni T. G. Shevchenko (Tadzhik U.S.S.R.)

Uch. Zap. Kazan. Vet. Inst.
Uchenye Zapiski Kazanskogo Veterinarnogo Instituta (U.S.S.R.)

Uch. Zap., Latv. Gos. Univ.
Uchenye Zapiski, Latviiskii Gosudarstvennyi Universitet Im. P. Stuchki (Latvian S.S.R.)

Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk
Uchenye Zapiski Leningradskogo Gosudarstvennogo Ordena Lenina Universita imeni A. A. Zhdanova, Seriya Matematicheskikh Nauk (U.S.S.R.)

Uch. Zap., Perm. Gos. Univ.
Uchenye Zapiski, Permskii Gosudarstvennyi Universitet imeni A. M. Gor'kogo (U.S.S.R.)

Uch. Zap. Ul'yanovsk. Gos. Pedagog. Inst.
Uchenye Zapiski Ul'yanovskogo Gosudarstvennogo Pedagogicheskogo Instituta (U.S.S.R.)

Ugeskr. Laeger
Ugeskrift for Laeger (Denmark)

Ukr. Biokhim. Zh.
Ukrainskii Biokhimichnii Zhurnal (Ukrainian S.S.R.)

Ukr. Fiz. Zh.
Ukrainskii Fizicheskii Zhurnal (Ukrainian S.S.R.) (Russian Version)

Ukr. Khim. Zh.
Ukrainskii Khimicheskii Zhurnal (Ukrainian S.S.R.)
Issued in English Translation as Soviet Progress in Chemistry

Ukr. Math. J. (Engl. Transl.)
Ukrainian Mathematical Journal (English Translation Of Ukrainskii Matematicheskii Zhurnal) (U.S.)

Ultrasonics
Ultrasonics (England)

Umschau
Umschau, Die (West Germany)

Umsch. Forschritte Wiss. Tech.
Umschau Ueber die Forschritte in Wissenschaft und Technik, Die (West Germany)

Umsch. Wiss. Tech.
Umschau in Wissenschaft und Technik (West Germany)

Underwater Sci. Technol. J.
Underwater Science and Technology Journal (England)

Union Burma J. Life Sci.
Union of Burma Journal of Life Sciences (Burma)

Union Burma J. Sci. Technol.
Union of Burma Journal of Science and Technology (Burma)

Union Med. Can.
Union Medicale du Canada, L (Canada)

United Fresh Fruit Veg. Ass., Yearb.
United Fresh Fruit and Vegetable Association, Yearbook (U.S.)

Univ. Roorkee, Res. J.
University of Roorkee, Research Journal (India)

Urania (Krakow)
Urania (Krakow) (Poland)

Urol. Int.
Urologia Internationalis (Switzerland)

Urologe
Urologe (West Germany)

Urologia
Urologia (Italy)

USAF Nucl. Saf.
USAF Nuclear Safety (U. S.)

U. S., Dep. Agr., Tech. Bull.
United States, Department of Agriculture, Technical Bulletin (U. S.)

U. S., Geol. Surv., Prof. Pap.
United States Department of the Interior, Geological Survey, Professional Paper (U.S.)

Usp. Fiz. Nauk
Uspekhi Fizicheskikh Nauk (U.S.S.R.)
Issued in English Translation as Soviet Physics- Uspekhi

Usp. Nauch. Fotogr.
Uspekhi Nauchnoi Fotografii (U.S.S.R.)

Usp. Sovrem. Biol.
Uspekhi Sovremennoi Biologii (U.S.S.R.)

Usp. Sovrem. Genet.
Uspekhi Sovremennoi Genetiki (U.S.S.R.)

Utah State Univ., Agr. Exp. Sta., Bull.
Utah State University, Agricultural Experiment Station, Bulletin (U.S.)

Uzb. Biol. Zh.
Uzbekskii Biologicheskii Zhurnal, Akademiya Nauk Uzbekskoi SSR (Uzbek S.S.R.)

Uzb. Khim. Zh.
Uzbekskii Khimicheskii Zhurnal, Akademiya Nauk Uzbekskoi SSR (Uzbek S.S.R.)

V

Vacuum
Vacuum. The International Journal and Abstracting Service for Vacuum Research and Technology (England)

Vakuum-Tech.
Vakuum-Technik (West Germany)

Valtion Tek. Tutkimuslaitos, Julk.
Valtion Teknillinen Tutkimuslaitos, Julkaisu (Finland)

Va. Med. Mon.
Virginia Medical Monthly (U.S.)

VDI (Ver. Deut. Ing.) Nachr.
VDI (Verein Deutscher Ingenieure) Nachrichten (West Germany)

VDI (Ver. Deut. Ing.) Z.
VDI (Verein Deutscher Ingenieure) Zeitschrift fuer die Gesamte Technik
(Formerly VDI (Verein Deutscher Ingenieure) Zeitschrift) (West Germany)

Veda Tech. Mladezi
Veda a Technika Mladezi (Czechoslovakia)

Verh. Deut. Ges. Inn. Med.
Verhandlungen der Deutschen Gesellschaft fuer Innere Medizin (West Germany)

Verh. Deut. Ges. Pathol.
Verhandlungen der Deutschen Gesellschaft fuer Pathologie (West Germany)

Veroeff. Morphol. Pathol.
Veroeffentlichungen aus der Morphologischen Pathologie (West Germany)

Verres Refract.
Verres et Refractaires (France)

Vestn. Akad. Med. Nauk SSSR
Vestnik Akademii Meditsinskikh Nauk SSSR (U.S.S.R.)

Vestn. Akad. Nauk Kaz. SSR
Vestnik Akademii Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Vestn. Akad. Nauk SSSR
Vestnik Akademii Nauk SSSR (U.S.S.R.)

Vestn. Dermatol. Venerol.
Vestnik Dermatologii i Venerologii (U.S.S.R.)

Vestn. Khir.
Vestnik Khirurgii imeni I. I. Grekova (U.S.S.R.)

Vestn. Leningrad. Univ., Fiz., Khim.
Vestnik Leningradskogo Universiteta, Fizika, Khimiya
(Formerly Vestnik Leningradskogo Universiteta, Seriya Fiziki i Khimii) (U.S.S.R.)

Vestn. Leningrad. Univ., Ser. Fiz. Khim
Vestnik Leningradskogo Universiteta, Seriya Fiziki i Khimii (U.S.S.R.)
Changed to Vestnik Leningradskogo Universiteta, Fizika, Khimiya

Vestn. Mosk. Univ., Biol. Pochvoved.
Vestnik Moskovskogo Universiteta, Biologiya, Pochvovedenie
(Continues in part Vestnik Moskovskogo Universiteta, Seriya Biologii, Pochvovedeniya, Geologii, Geografii) (U.S.S.R.)

Vestn. Mosk. Univ., Ser. II. Khim.
Vestnik Moskovskogo Universiteta, Seriya II. Khimiya
(Formerly a Part of Vestnik Moskovskogo Universiteta, Seriya Matematiki, Mekhaniki, Astronomii, Fiziki i Khimii) (U.S.S.R.)

Vestn. Mosk. Univ., Ser. III. Fiz. Astron.
Vestnik Moskovskogo Universiteta, Seriya III. Fizika, Astronomiya (U.S.S.R.)

Vestn. Otorino-Laringol.
Vestnik Otorino-Laringologii (U.S.S.R.)

Vestn. Rentgenol. Radiol.
Vestnik Rentgenologii i Radiologii (U.S.S.R.)

Vestn. Sel'skokhoz. Nauki (Moscow)
Vestnik Sel'skokhozyaistvennoi Nauki (Moscow) (U.S.S.R.)

Vestn. Slov. Kem. Drus.
Vestnik Slovenskega Kemijskega Drustva (Yugoslavia)

Vestn. Vyssh. Shk.
Vestnik Vysshei Shkoly (U.S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk
Vestsi Akademii Navuk BSSR, Seryya Biyalagichnykh Navuk
(Formerly Carried as Vestsi Akademii Navuk Belaruskai SSR, Seryya Biyalagichnykh Navuk) (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk
Vestsi Akademii Navuk BSSR, Seryya Fizika-Matematychnykh Navuk (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Tekh. Navuk
Vestsi Akademii Navuk BSSR, Seryya Fizika-Tekhnichnykh Navuk (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, SSR, Ser. Khim. Navuk
Vestsi Akademii Navuk BSSR, SSR, Seryya Khimichnykh Navuk (Belorussian S.S.R.)

Veterinariya
Veterinariya (U.S.S.R.)

Vet. Ital.
Veterinaria Italiana (Italy)

Vet. Med. (Prague)
Veterinarni Medicina (Prague) (Czechoslovakia)

Vet. Med. Nauki (Sofia)
Veterinarno Meditsinski Nauki (Sofia), Izvestiya na Akademiyata na Selskostopanskite Nauki (Bulgaria)

Vetro Silicati
Vetro e Silicati (Italy)

Vide
Vide, Le, Technique-Applications (France)

Vierteljahresschr. Naturforsch. Ges. Zuerich
Vierteljahresschrift der Naturforschenden Gesellschaft in Zuerich (Switzerland)

Vijnana Parishad Anusandhan Patrika
Vijnana Parishad Anusandhan Patrika (India)

Virchows Arch., A
Virchows Archiv, A. Pathologische Anatomie (Formerly Archiv fuer Pathologische Anatomie und Physiologie and fuer Klinische Medizin, Virchows) (West Germany)

Virchows Arch., B
Virchows Archiv, B. Zellpathologie (Formerly Frankfurter Zeitschrift fuer Pathologie) (West Germany)

Virology
Virology (U.S.)

Vision Res.
Vision Research (England - U.S.)

Visn. Akad. Nauk Ukr. RSR
Visnik Akademii Nauk Ukrains'koi RSR (Ukrainian S.S.R.)

Visn. Kiiv. Univ., Ser. Astron.
Visnik Kiivs'kogo Universitetu, Seriya Astronomii (Ukrainian S.S.R.)

Visn. Kiiv. Univ., Ser. Fiz. Khim.
Visnik Kiivs'kogo Universitetu, Seriya Fiziki ta Khimii (Ukrainian S.S.R.)

Visn., L'viv. Derzh. Univ., Ser. Fiz.
Visnik, L'vivs'kii Derzhavnii Universitet Im. I. Franka, Seriya Fizichna (Ukrainian S.S.R.)

Visn. L'viv. Derzh. Univ., Ser. Khim.
Visnik L'vivs'kogo Derzhavnogo Universitetu im. Ivana Franka, Seriya Khimichna (Urkainian S.S.R.)

Vistas Astron.
Vistas in Astronomy (England)

Vital Health Statist.
Vital and Health Statistics (U.S.)

Vitalst. Zivilisationskr.
Vitalstoffe Zivilisationskrankheiten (West Germany)

Vnitr. Lek.
Vnitrni Lekarsivi (Czechoslovakia)

Voenno Med. Delo
Voenno Meditsinsko Delo (Bulgaria)

Voenno-Med. Zh.
Voenno-Meditsinskii Zhurnal (U.S.S.R.)

Vojnosanit. Pregl.
Vojnosanitetski Pregled (Yugoslavia)

Voj. Zdravot. Listy
Vojenske Zdravotnicke Listy (Czechoslovakia)

Vop. Kurortol., Fizioter. Lech. Fiz. Kul't.
Voprosy Kurortologii, Fizioterapii i Lechebnoi Fizicheskoi Kul'tury (U.S.S.R.)

Vop. Med. Khim.
Voprosy Meditsinskoi Khimii (U.S.S.R.)

Vop. Neirokhir.
Voprosy Neirokhirurgii (U.S.S.R.)

Vop. Onkol.
Voprosy Onkologii (U.S.S.R.)

Vop. Pitan.
Voprosy Pitaniya (U.S.S.R.)

Vop. Radiobiol., Sb. Tr.
Voprosy Radiobiologii, Sbornik Trudov (Armenian S.S.R.)

Vop. Virusol.
Voprosy Virusologii. (U.S.S.R.

Vox Sang.
Vox Sanguinis. Journal of Blood Transfusion and Immono-Haematology (Switzerland)

Vrach. Delo
Vrachebnoe Delo (Ukrainian S.S.R.)

W

Waerme Stoffuebertrag.
Waerme- und Stoffuebertragung (West Germany)

Wakayama Igaku
Wakayama Igaku (The Journal of the Wakayama Medical Society) (Japan)

Waseda Daigaku Rikogaku Kenkyusho Hokoku
Waseda Daigaku Rikogaku Kenkyusho Hokoku (Bulletin of the Scientific and Engineering Research Laboratory Waseda University) (Japan)

Wasserwirtschaft
Wasserwirtschaft, Die (West Germany)

Water Res.
Water Research (Supersedes in Part Air and Water Pollution) (England)

Water Resour. Res.
Water Resources Research (U.S.)

Water Sewage Works
Water and Sewage Works (U.S.)

Water Wastes Eng.
Water and Wastes Engineering (U.S.)

Wear
Wear (Netherlands)

Weld. Eng.
Welding Engineer (U.S.)

Weld. J. (N.Y.)
Welding Journal, The (New York) (U.S.)

Weld. Metal. Fabr.
Welding and Metal Fabrication (Formerly Welding) (England)

Weld. Prod. (USSR) (Engl. Transl.)
Welding Production (USSR) (English Translation of Svarochnoe Proizvodstvo) (England)

Weld. Res. (N. Y.) (Publ. in Weld. J.)
Welding Research (New York) (Published in Welding Journal as a supplement) (U. S.)

Werkst. Korros.
Werkstoffe und Korrosion (West Germany)

West. Mach. Steel World
Western Machinery and Steel World (U.S.)

West. Miner
Western Miner (Canada)

Wiad. Lek.
Wiadomosci Lekarskie (Poland)

Wiad. Parazytol.
Wiadomosci Parazytologiczne (Poland)

Wien. Klin. Wochenschr.
Wiener Klinische Wochenschrift (Austria)

Wien. Med. Wochenschr.
Wiener Medizinische Wochenschrift (Austria)

Wien. Tieraerztl. Monatsschr.
Wiener Tieraerztliche Monatsschrift (Austria)

Wildlife Dis. Ass., Bull.
Wildlife Disease Association, Bulletin (U.S.)

Wilhelm Roux' Arch. Entwicklungsmech. Organismen
Wilhelm Roux' Archiv fuer Entwicklungsmechanik der Organismen (West Germany)

Wis. Med. J.
Wisconsin Medical Journal (U.S.)

Wiss. Ber. AEG-Telefunken
Wissenschaftliche Berichte AEG-Telefunken (Continuation of Telefunken-Zeitung) (West Germany)

Wiss. Z. Friedrich-Schiller-Univ., Jena, Math.-Naturwiss. Reihe
Wissenschaftliche Zeitschrift der Friedrich-Schiller-Universitaet, Jena, Mathematisch-Naturwissenschaftliche Reihe (East Germany)

Wiss. Z. Humboldt-Univ. Berlin, Math.-Naturwiss. Reihe
Wissenschaftliche Zeitschrift der Humboldt-Universitaet zu Berlin, Mathematisch-Naturwissenschaftliche Reihe (East Germany)

Wiss. Z. Tech. Hochsch. Chem. Leuna-Merseburg
Wissenschaftliche Zietschrift der Technischen Hochschule fuer Chemie Leuna-Merseburg (East Germany)

Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt
Wissenschaftliche Zeitschrift der Technischen Hochschule Karl-Marx-Stadt (East Germany)

Wiss. Z. Tech. Hochsch. Otto von Guericke Magdeburg
Wissenschaftliche Zeitschrift der Technischen Hochschule Otto von Guericke Magdeburg (East Germany)

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Wissenschaftliche Zeitschrift der Technischen Universitaet Dresden (Formerly Wissenschaftliche Zeitschrift der Technischen Hochschule Dresden) (East Germany)

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Wissenschaftliche Zeitschrift der Universitaet Rostock, Mathematisch-Naturwissenschaftliche Reihe (East Germany)

WMO (World Meteorol. Organ.) Bull.
WMO (World Meteorological Organization) Bulletin (Switzerland)

World Health Organ., Tech. Rep. Ser.
World Health Organization, Technical Report Series (Switzerland)

World Med. Electron.
World Medical Electronics (England)

World Med. Instrum.
World Medical Instrumentation (formerly World Medical Electronics) (England)

Wszechswiat
Wszechswiat (Poland)

Y

Yadern. Fiz.
Yadernaya Fizika (U.S.S.R.)
Issued in English Translation as Soviet Journal of Nuclear Physics

Yaderno-Geofiz. Issled., Geofiz. Sb.
Yaderno-Geofizicheskie Issledovaniya, Geofizicheskii Sbornik (U.S.S.R.)

Yakugaku Zasshi
Yakugaku Zasshi (Journal of the Pharmaceutical Society of Japan) (Japan)

Yale J. Biol. Med.
Yale Journal of Biology and Medicine, The (U.S.)

Yamagata Daigaku Kiyo, Kogaku
Yamagata Daigaku Kiyo, Kogaku (Bulletin of the Yamagata University, Engineering) (Japan)

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Yamaguchi Daigaku Kogakubu Kenkyu Hokoku (Memoirs of the Faculty of Engineering Yamaguchi University) (Japan)

Yogyo Kyokai Shi
Yogyo Kyokai Shi (Journal of the Ceramic Association of Japan) (Japan)

Yokohama Igaku
Yokohama Igaku (The Yokohama Medical Journal) (Japan)

Yokohama Med. Bull.
Yokohama Medical Bulletin (Japan)

Yonago Acta Med.
Yonago Acta Medica (Japan)

Yonago Igaku Zasshi
Yonago Igaku Zasshi (The Journal of the Yonago Medical Association) (Japan)

Yosetsu Gakkaishi
Yosetsu Gakkaishi (Journal of the Japan Welding Society) (Japan)

Yosetsu Gijutsu
Yosetsu Gijutsu (Welding Technique) (Japan)

Your Radiol. (Chicago)
Your Radiologist (Chicago) (U.S.)

Yukagaku
Yukagaku (Journal of Japan Oil Chemists Society) (Japan)

Z

Z. Aerztl. Fortbild.
Zeitschrift fuer Aerztliche Fortbildung (East Germany)

Zahnaerztl. Mitt.
Zahnaerztliche Mitteilungen (West Germany)

Z. Allg. Mikrobiol.
Zeitschrift fuer Allgemeine Mikrobiologie Morphologie, Physiologie, und Oekologie der Mikroorganismen (East Germany)

Z. Anal. Chem.
Zeitschrift fuer Analytische Chemie, Fresenius (East Germany)

Z. Angew. Entomol.
Zeitschrift fuer Angewandte Entomologie (West Germany)

Z. Angew. Geol.
Zeitschrift fuer Angewandte Geologie (East Germany)

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Zeitschrift fuer Angewandte Mathematik und Mechanik (East Germany)

Z. Angew. Math. Phys.
Zeitschrift fuer Angewandte Mathematik und Physik (Switzerland)

Z. Angew. Phys.
Zeitschrift fuer Angewandte Physik (West Germany)

Z. Anorg. Allg. Chem.
Zeitschrift fuer Anorganische und Allgemeine Chemie (East Germany)

Zashch. Metal.
Zashchita Metallov (U.S.S.R.)
Issued in English Translation as Protection of Metals (USSR)

Zashch. Rast. (Moscow)
Zashchita Rastenii (Moscow) (U.S.S.R.)

Z. Astrophys.
Zeitschrift fuer Astrophysik (West Germany)
Superseded by Astronomy and Astrophysics

Zavod. Lab.
Zavodskaya Laboratoriya (U.S.S.R.)
For English Translation see Industrial Laboratory (USSR)

Zdravookhranenie (Kishinev)
Zdravookhranenie (Kishinev) (Moldavian S.S.R.)

Zdravookhr. Beloruss.
Zdrovookhranenie Belorussii (Belorussian S.S.R.)

Zdravookhr. Turkm.
Zdravookhranenie Turkmenistana (Turkmen S.S.R.)

Zdrav. Tech. Vzduchotech.
Zdravotni Technika A Vzduchotechnika (Czechoslovakia)

Zdrow. Publiczne
Zdrowie Publiczne (Poland)

Zem. Beton
Zement und Beton (Austria)

Zemledelie
Zemledelie (U.S.S.R.)

Zemlya Vselennaya
Zemlya i Vselennaya (U.S.S.R.)

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Zentralblatt fuer Allgemeine Pathologie und Pathologische Anatomie (East Germany)

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Zentralblatt fuer Arbeitsmedizin und Arbeitsschutz (West Germany)

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Zentralblatt fuer Bakteriologie. Parasitenkunde, Infektionskrankheiten und Hygiene, Abteilung I. Originale (East Germany)

Zentralbl. Chir.
Zentralblatt fuer Chirurgie (East Germany)

Zentralbl. Chir., Suppl.
Zentralblatt fuer Chirurgie, Supplement (East Germany)

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Zentralblatt fuer Gynaekologie (East Germany)

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Zentralblatt fuer Phlebologie (Switzerland)

Zentralbl. Veterinaermed., Reihe B
Zentralblatt fuer Veterinaermedizin, Reihe B (West Germany)

Z. Ernaehrungswiss.
Zeitschrift fuer Ernaehrungswissenschaft. Journal of Nutritional Sciences. Journal des Sciences de la Nutrition (West Germany)

Z. Erzbergbau Metallhuettenw.
Zeitschrift fuer Erzbergbau und Metallhuettenwesen (West Germany)

Zesz. Nauk. Mat., Fiz., Chem., Wyzsza Szkola Pedagog. Gdansku
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Zeszyty Naukowe Wyzszej Szkoly Pedagogicznej w Katowicach, Sekcja Fizyki (Poland)

Zesz. Probl. Postepow Nauk Roln.
Zeszyty Problemowe Postepow Nauk Rolniczych (Poland)

Z. Flugwiss.
Zeitschrift fuer Flugwissenschaften (Germany)

Z. Geburtsh. Gynaekol.
Zeitschrift fuer Geburtshilfe und Gynaekologie (West Germany)

Z. Geophys.
Zeitschrift fuer Geophysik (West Germany)

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Zeitschrift fuer Gesamte Experimentelle Medizin Zugleich Fortsetzung der Zeitschrift fuer Experimentelle Pathologie und Therapie (West Germany)

Z. Gesam. Hyg. Ihre Grenzgeb.
Zeitschrift fuer die Gesamte Hygiene und Ihre Grenzgebiete (Germany)
(East Germany)

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Zeitschrift fuer die Gesamte Innere Medizine und Ihre Grenzgebiete (East Germany)

Zh. Anal. Khim.
Zhurnal Analiticheskoi Khimii (U.S.S.R.)
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Z. Haut- Geschlechtskr.
Zeitschrift fuer Haut- und Geschlechtskrankheiten (Germany)

Zh. Eksp. Klin. Med.
Zhurnal Eksperimentalnoi i Klinicheskoe Meditsiny (Armenian S.S.R.)

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Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki (U.S.S.R.)
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Zhurnal Nauchnoi i Prikladnoi Fotografii i Kinematografii (U.S.S.R.)

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Zhurnal Prikladnoi Spektroskopii (Belorussian S.S.R.)
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Zhurnal Strukturnoi Khimii (U.S.S.R.)
Issued in English Translation as Journal of Structural Chemistry (USSR)

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Zhurnal Tekhnicheskoi Fiziki (U.S.S.R.)
For English Translation see Soviet Physics-Technical Physics (U.S.)

Zh. Ushnykh Nosovykh Gorlovykh Bolez.
Zhurnal Ushnykh Nosovykh i Gorlovykh Bolezuei (Ukrainian S.S.R.)

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Zhurnal Vychislitelnoi Matematiki i Matematicheskoi Fiziki (U.S.S.R.)

Zh. Vyssh. Nerv. Deyatelm. im. I. P. Pavlova
Zhurnal Vysshei Nervnoi Deyatelnosti imeni I. P. Pavlova (U.S.S.R.)

Z. Immunitaetsforsch., Allergie Klin. Immunol.
Zeitschrift fuer Immunitaetsforschung, Allergie und Klinische Immunologie (West Germany)

ZIS (Zentralinst. Schweisstech.)-Mitt.
ZIS (Zentralinstitut fuer Schweisstechnik)-Mitteilungen (East Germany)

Z. Klin. Chem. Klin. Biochem.
Zeitschrift fuer Klinische Chemie und Klinische Biochemie (Formerly Zeitschrift fuer Klinische Chemie) (West Germany)

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Zeitschrift fuer Krebsforschung (West Germany)

Z. Kreislaufforsch.
Zeitschrift fuer Kreislaufforschung (West Germany)

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Zeitschrift fuer Lebensmittel-Untersuchung und -Forschung (West Germany)

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Zeitschrift fuer Medizinische Labortechnik (East Germany)

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Z. Metallk.
Zeitschrift fuer Metallkunde (West Germany)

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Zeitschrift fuer Meteorologie (East Germany)

Z. Mikrosk.-Anat. Forsch.
Zeitschrift Fuer Mikroskopisch-Anatomische Forschung (Abt. 2 of Jahrbuch fuer Morphologie und Mikroskopische Anatomie) (East Germany)

Z. Morphol. Oekol. Tiere
Zeitschrift fuer Morphologie und Oekologie der Tiere (West Germany)
Superseded in part by Oecologia (Berlin)

Znanie-Sila
Znanie-Sila (U.S.S.R.)

Z. Naturforsch., A
Zeitschrift fuer Naturforschung, Part A (West Germany)

Z. Naturforsch., B
Zeitschrift fuer Naturforschung. Part B (West Germany)

Zool. Zh.
Zoologicheskii Zhurnal (U.S.S.R.)

Z. Orthop. Ihre Grenzgeb.
Zeitschrift fuer Orthopaedie und Ihre Grenzgebiete (West Germany)

Z. Parasitenk.
Zeitschrift fuer Parasitenkunde (West Germany)

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Zeitschrift fuer Pflanzenphysiologie (West Germany)

Z. Pflantzenzuecht.
Zeitschrift fuer Pflantzenzuechtung (Germany)

Z. Phys.
Zeitschrift fuer Physik (West Germany)

Z. Phys. Chem. (Frankfurt)
Zeitschrift fuer Physikalische Chemie (Frankfurt) (West Germany)

Z. Phys. Chem. (Leipzig)
Zeitschrift fuer Physikalische Chemie (Leipzig) (East Germany)
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Z. Physiol. Chem.
Zeitschrift fuer Physiologische Chemie, Hoppe-Seylers (West Germany)

Z. Schweisstech.
Zeitschrift fuer Schweisstechnik (Switzerland)

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Zeitschrift fuer Tuberkulose und Erkrankungen der Thoraxorgane (East Germany)

Z. Unfallmed. Berufskr.
Zeitschrift fuer Unfallmedizin und Berufskrankheiten (Austria)

Z. Urol.
Zeitschrift fuer Urologie (East Germany)

Zvaranie
Zvaranie (Czechoslovakia)

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Zeitschrift fuer Vergleichende Physiologie (West Germany)

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Zeitschrift fuer Wissenschaftliche Mikroskopie und fuer Mikroskopische Technik (West Germany)

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Zeitschrift fuer Zellforschung und Mikroskopische Anatomie (West Germany)

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